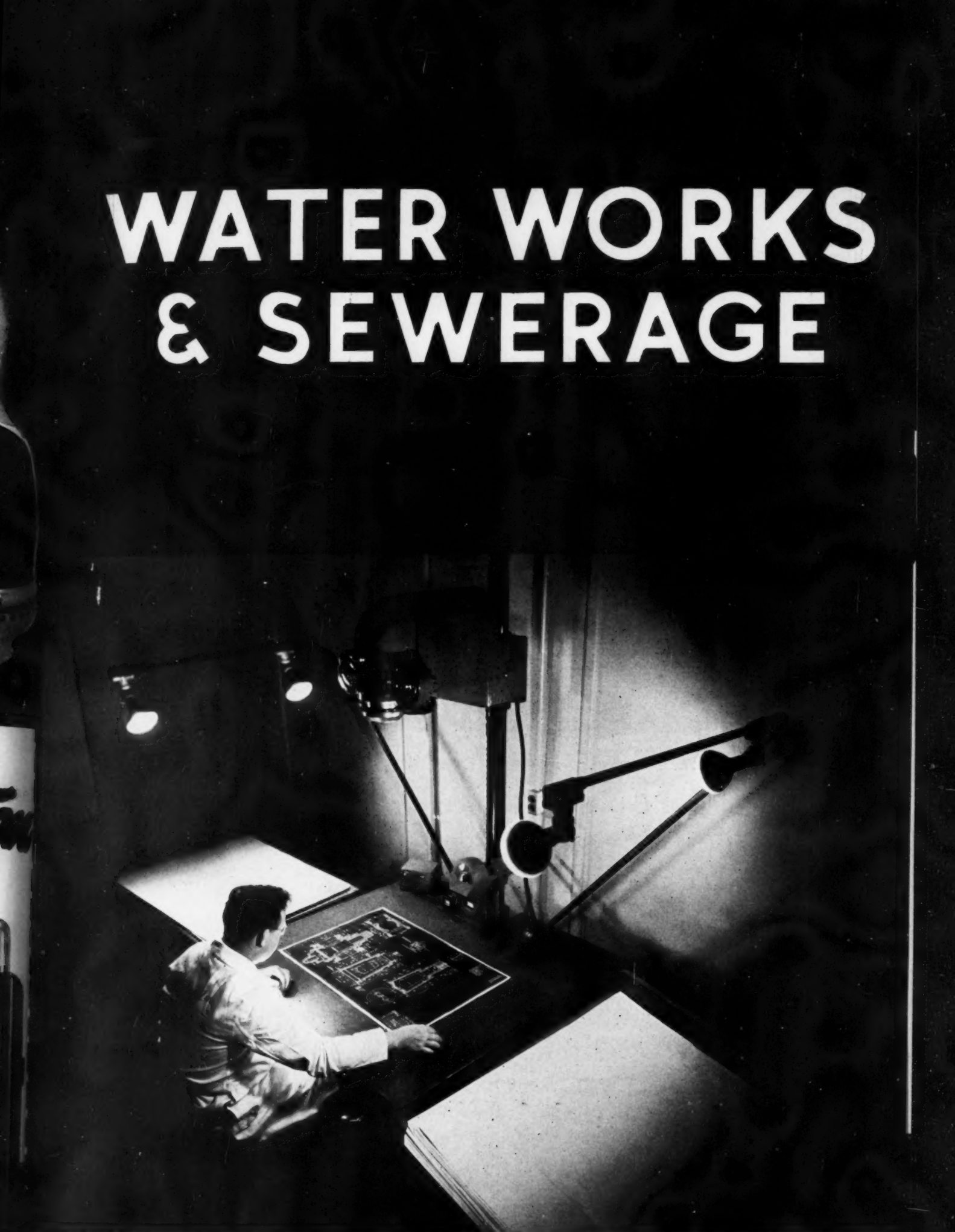
WATER WORKS & SEWERAGE



"MICROFILMING"

The Modern Method of Record Condensation, Preservation and Perpetuation

Chlorine

FRIEND OF THE FIGHTING MAN!

On our far-flung battlefronts around the world—from the polar ice-cap to the jungles "down under"—chlorine befriends our fighting forces.

This protective chemical aids in defeating one of the most dangerous and destructive of enemies—water-borne disease. Chlorine carries the big load in making drinking water safe. Its compounds serve as valuable bactericides in dressing stations and hospitals—are used by camp laundries to sanitize clothes and supplies. They also safeguard soldiers' feet against infection.

Penn Salt manufactures

Perchloron

REG. U.S. PAT. OFF.

for emergency water sanitation

Also

Liquid Chlorine • Anhydrous Ammonia
Filter Alum • Ferric Chloride
Sodium Aluminate • Chloride of Lime
Caustic Soda and other products

Penn Salt produces considerable quantities of chlorine and chlorine compounds for these vital military duties . . . And while these needs may limit our supply for other uses, our wartime obligations are giving us opportunities to amplify and improve our production and service—benefits which you will enjoy when we can serve you without restriction, after Victory.

PENNSYLVANIA SALT MANUFACTURING COMPANY

Chemicals

1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

New York • Chicago • St. Louis • Pittsburgh • Minneapolis • Wyandotte • Tacoma

WATER WORKS & SEWERAGE, December, 1943. Volume 90, Number 12. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under act of March 3, 1879.

The Seed of Today is the Tree of Tomorrow

HE who has longed for the cool shade of a mighty oak in his front lawn, or for a row of productive fruit trees in the back yard—this man knows that the planting of the seed must, by many years, precede the fulfillment of his dreams.

So it is with the attainment of life's goals—a home, position and independence. So it is with the United Nations today in their quest for the four Freedoms. The seed for a sturdy tree of world security was planted the day we and our Allies went all-out against tyranny. It has taken a while for our tree to mature and bear fruit, but because we moved when we did we are assured of success in the eventual victory.

While we in the Pittsburgh Equitable Meter Company and Merco Nordstrom Valve Company are now chiefly engaged in the production of materials for winning this war, we are also energetically planning for the future. The Research, Engineering and Development programs of our organization are being intensified. New designs are taking form on the drawing boards. Experiments with new materials and new models are taking place in the laboratories. Our Standards Department, which was recently awarded the "A" Rating for quality control by the U. S. Army Air Forces, will apply exacting precision over the manufacturing procedure in our products of tomorrow.

FROM TODAY'S RESEARCH AND PLANNING WILL COME OUR PRODUCTS OF TOMORROW

With the coming of world peace, our five factories will resume their principal role of building accurate and dependable meters, valves, regulators and similar items for measurement and control. As manufacturers of precision equipment, we expect the educated post-war buyer to demand and recognize only the highest quality and serviceability. In the end, the harvest of the seeds that we are sowing today will be garnered by the equipment users of tomorrow.

PITTSBURGH EQUITABLE METER COMPANY

BOSTON BROOKLYN BUFFALO CHICAGO COLUMBUS HOUSTON KANSAS CITY

MERCO NORDSTROM VALVE COMPANY
Main Offices, Pittsburgh, Pa

NATIONAL METER DIVISION, Brooklyn, N Y

LOS ANGELES NEW YORK PITTSBURGH SAN FRANCISCO SEATTLE TULSA

BACK THE ATTACK WITH WAR BONDS

PITTSBURGH-NATIONAL IRON CASE WATER METERS

E VICTORY METERS
Sizes ⅝" and ¾" x ¾"

IRONSIDE WATER METERS
Sizes ⅝" through 2"

EMPIRE TYPE 9 METERS
Sizes ¾" and 1"

GEM WATER METERS
Sizes 2" through 12"

EMPIRE LARGE CAPACITY METERS
Sizes 1½" through 6"

EMPIRE COMPOUND METERS
Sizes 3" through 12"

AMERICAN WASTE TREATMENT EQUIPMENT

Grit Removal Design No. 249

The theory, practice and equipment for grit removal.

Screens . . . . No. 258

Complete information on the removal and cutting of screenings.

Pre-Aeration — Grease Flotation . No. 260

The application of beneficial pre-treatment for new existing plants.

Sludge Removal . No. 253

Conveyors for removal of sludge and the design of sedimentation tanks.

Rotary Distributors No. 257

Distributors to meet all field conditions. Recommendations for filters.

Aeration Equipment No. 254

Principles of Activated Sludge plant design. Aeration equipment required.

Sewage Pumps . . No. 250

Horizontal and Vertical. Specifications, illustrations, dimensions and selection tables.

Sludge Pumps . . . No. 261

Information on pumps, sludge pumping, typical piping layout and pipe friction curves for sludge.

Buy American

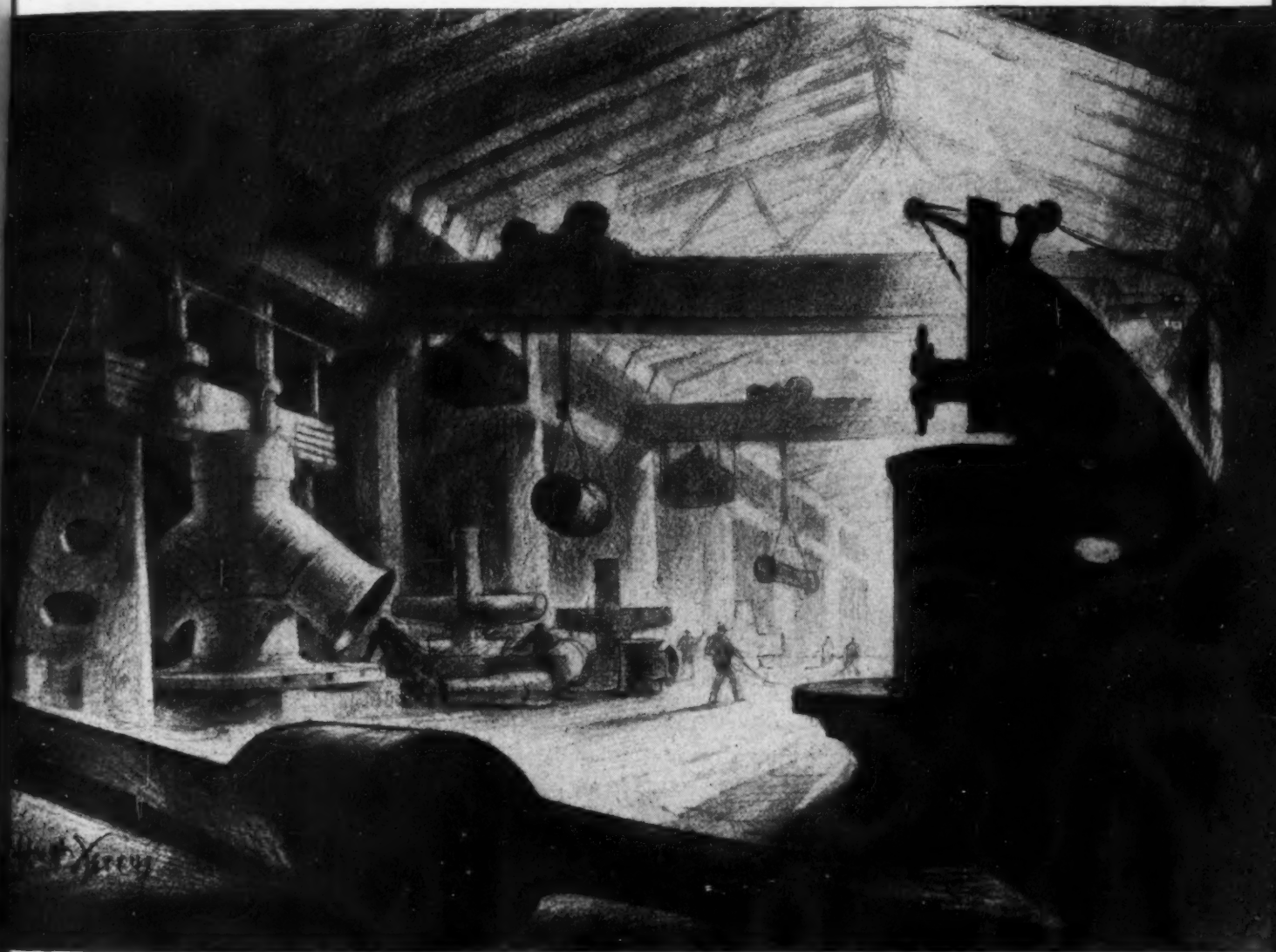
AMERICAN ESTABLISHED 1868

THE AMERICAN WELL WORKS
AURORA ILLINOIS
MANUFACTURERS OF
Pumping,—Sewage Treatment,—
and Water Purification Equipment

Wartime progress

Many thousands of tons of U. S. Cast Iron Pipe have been required for camps, air and naval bases, war plants and shipyards and their housing needs. With such war construction nearing completion, our pipe and fittings plants are again ready to produce promptly any requirements which cannot be immediately supplied from our amply-stocked storage yards.

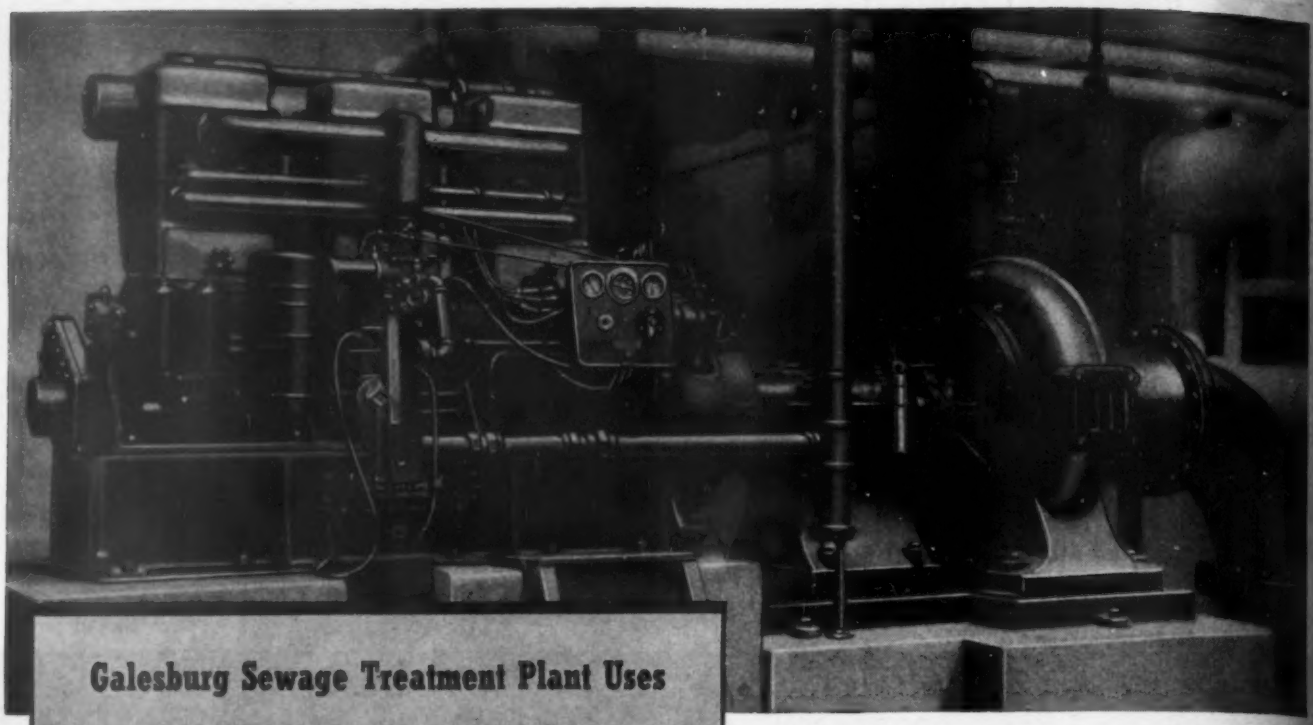
Meanwhile, our special foundries and machine shops are contributing further to the war effort in the production of marine and other castings, as well as munitions and parts for war materiel. Some of this special production has required developments in methods and equipment undreamed-of in cast iron pressure pipe foundries a decade ago.



A machine shop in one of our plants, drawn by Hugh Ferriss.

UNITED STATES PIPE & FOUNDRY CO.

General Offices: Burlington, New Jersey. ***Plants and Sales Offices throughout the U. S. A.***



Galesburg Sewage Treatment Plant Uses

A CLIMAX ENGINE

Instead of Former Electric Motor

RESULTS:

Total cost of installation $5100.00

Savings in 27 months' operation . . $5699.20

The Galesburg Climax Engine Data

Owner — Galesburg, Illinois Sanitary District.

Plant Superintendent — L. W. Hunt.

Consulting Engineers—Alvord, Burdick and Howson, Chicago.

Sewage Treatment Plant placed in operation June, 1931.

Equivalent population served —26,000.

Gas production (3-year period) daily average—26,525 cu. ft.

In September, 1940, a 60 hp. Climax Sewage Gas Engine, direct connected to a 6 M.G.D. sewage pump, replaced a 60 hp. electric motor.

The consulting engineers estimated that the savings made by the Climax Engine would pay for the installation within 3 years.

The following data is taken from Mr. Hunt's report for the year ending December 31, 1942.

Total hours in service to January 1, 1943—17,104.

Cubic ft. gas consumed per million gallon sewage pumped—3,354.

Total installed cost of engine—$5,100.00.

Savings in power cost for 27 months' operation—(purchased power cost $2.07 per KWH)—$5,699.20.

Time required for savings to equal total cost of engine installation—24 months.

Dividends on original investment 50% per annum.

Let's sit down and figure out what savings and improvements we can make in your plant....

Right Now, from sewage gas, your plant can generate 1 hp-hr. for every 17 persons served. If you are serving 100,000 people your sewage gas has a cash value of $17,000.00 per year—if converted into energy by Climax Sewage Gas Engines.

You Can Modernize old plants with Climax Engines installed in place of your present power, and the improvements will quickly pay for themselves.

You Can Make Power at far less cost than you can buy it. Sewage gas will provide all the power you need for lighting, heating of buildings and digesters, and to operate auxiliary mechanisms.

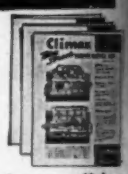
You Can Get Safe Power. Hazards are removed with standard flame traps, shut-off valves. Ample ventilation prevents accumulation of methane.

You Can End Stoppages due to purchased power failures. Records show 24-hour operation year after year without failure.

Another gain, often evaluated higher than dollars saved, is the credit you earn as an alert, competent, public-minded engineer.

SEND FOR INFORMATION

Write today for the Climax Engine Bulletins



Each covers a single Climax Engine — hp. ratings, performance curves, installation drawings, specifications and construction features.

Or write in detail and give us all information pertaining to conditions and power required for your plant.

ARMY-NAVY "E"

"For High Achievement in the Production of War Material"

Climax

Engineering Company

GENERAL OFFICES & FACTORY

CLINTON, IOWA

REGIONAL OFFICES CHICAGO, ILL. DALLAS, TEXAS

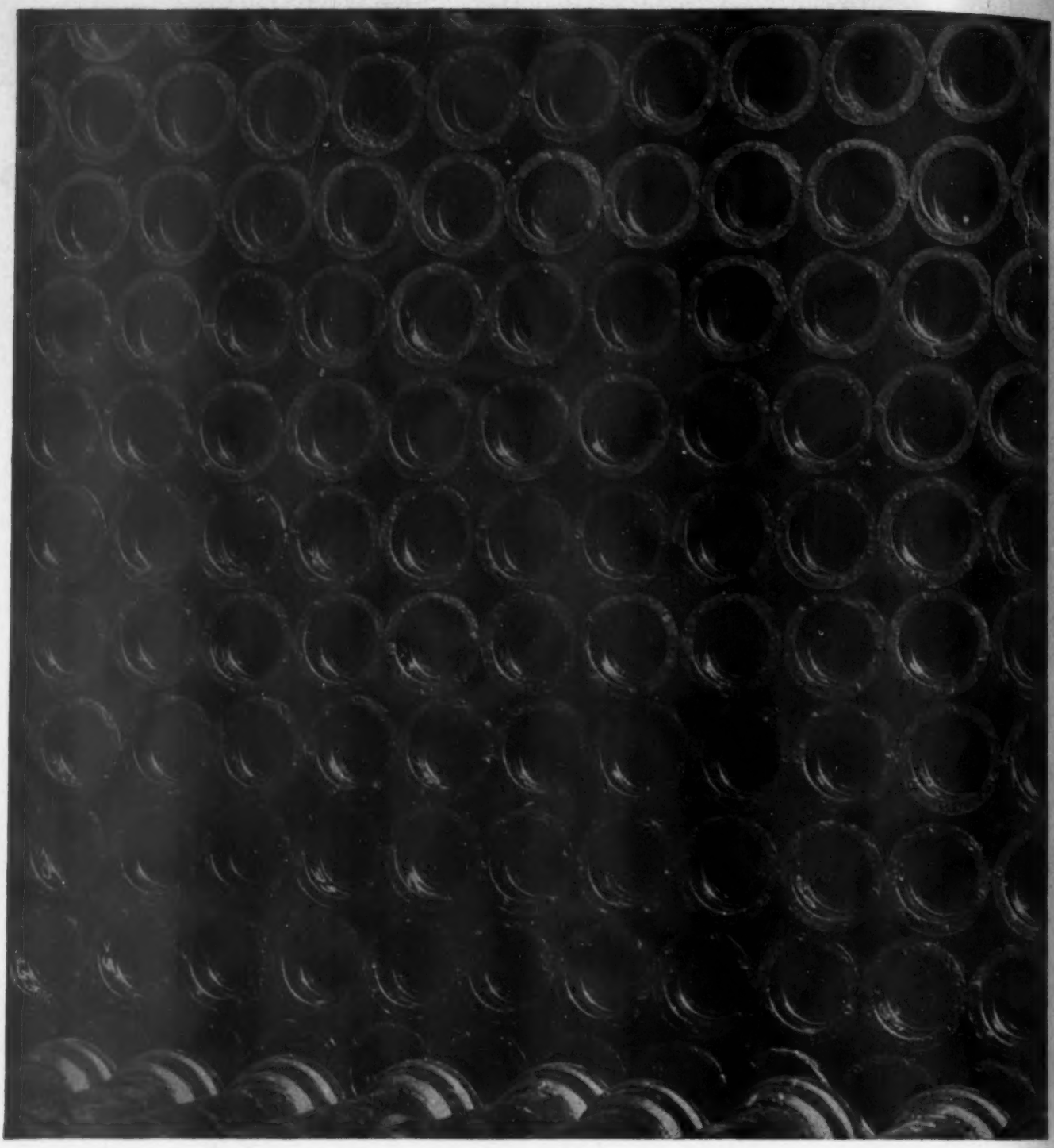
Liquid Chlorine

During the tense stress of wartime conditions, the constant manufacturing control and rigid supervision of Diamond Liquid Chlorine are more important than ever before. The resulting high standard of purity, close uniformity and dependability makes Diamond Liquid Chlorine first choice among waterworks and sewage engineers everywhere.

CHLORINE

DIAMOND ALKALI COMPANY . . . PITTSBURGH, PA.

and Everywhere



QUICKLY AVAILABLE...

and more economical than ever

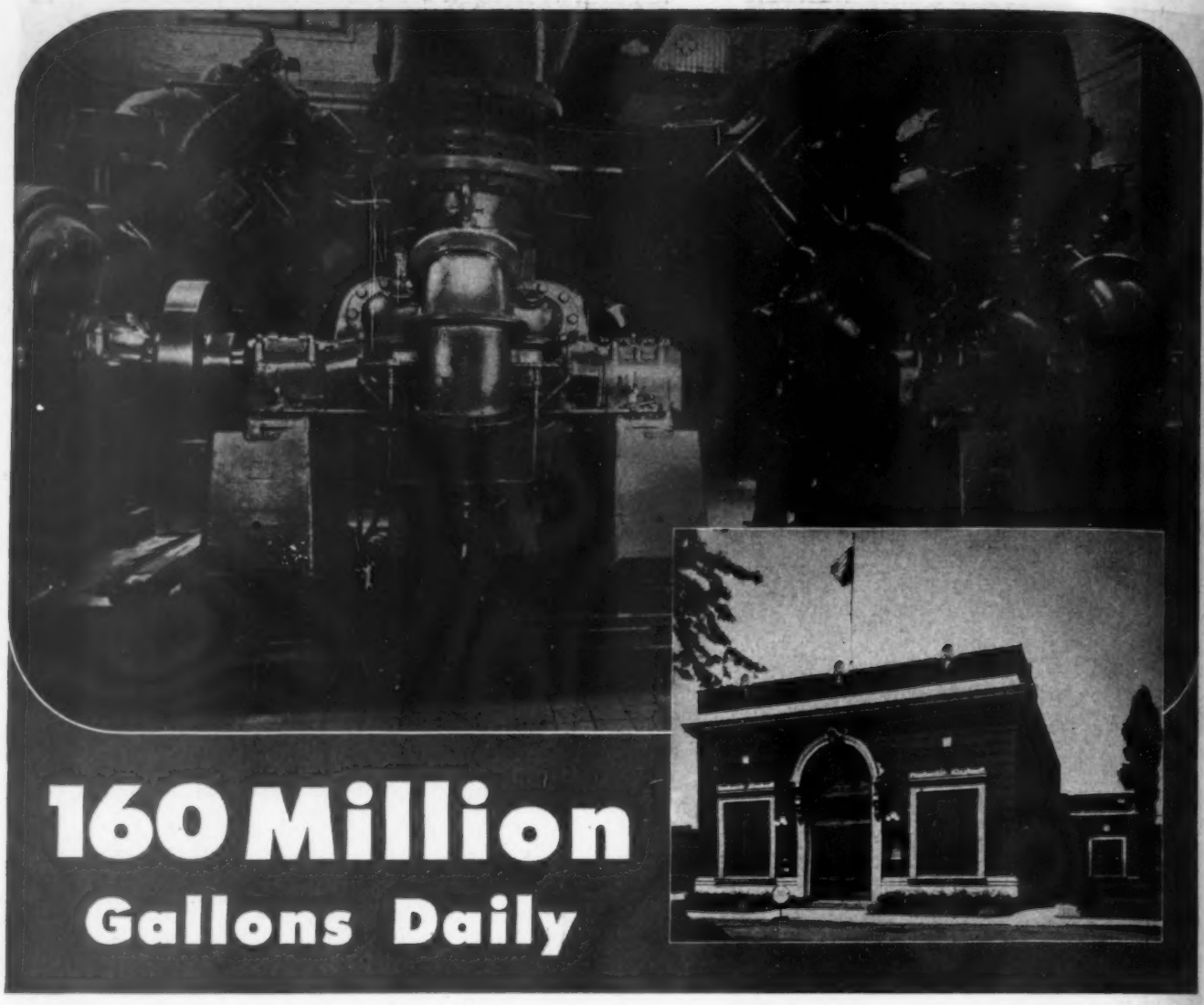
As the above photograph suggests, the storage yards of our members are amply stocked with cast iron pipe in commonly-used sizes.

By quickly available we mean that you can get cast iron pipe right out of stock from the storage yards of our members—in the most frequently used sizes—and with standard fittings. If you have work that *must be done*—water supply, gas or sewerage construction—you can get pipe without delay if you specify cast iron pipe—the pipe that gives more than a century of useful service. Special requirements in pipe or fittings can be quickly produced.

By more economical than ever we mean that cast iron pipe made according to the new A.S.A. Law of Design, plus our advances in metallurgy and production methods, is not only an improved product but more economical in *average first cost for users as a whole.* Cast iron pipe, made according to this Law of Design approved by the American Standards Association, is scientifically correct as to weights and dimensions for specific service and installation conditions. The technical staffs of our members will gladly advise you how to take fullest advantage of the Law of Design in meeting your specific requirements—for current or postwar construction. *Blueprint now*—and in planning your postwar specifications, you can be sure that cast iron pipe will be promptly available after the Armistice. Our members' pipe foundries have, of necessity, been maintained at full efficiency because of the great demand for cast iron pipe in war construction.

RESEARCH ASSOCIATION, CHICAGO

NO. 1 TAX SAVER



160 Million Gallons Daily

Thomas Jefferson Pumping Station
uses four Fairbanks-Morse thirty-inch, double-suction pumps

A group of four Fairbanks-Morse thirty-inch, double-suction, single-stage, split-case pumps gives the Thomas Jefferson Pumping Station in Chicago a total capacity of 160,000,000 gallons of water daily. Installation of these pumps departs from the conventional in that suction is horizontal and discharge is vertical. Water is taken from Lake Michigan at the Wilson Avenue Crib, brought through five miles of tunnel and discharged through twenty-three miles of feeder mains. Each of these big pumps is driven by a 1200 hp. motor.

Modern pumping equipment such as is found at the Thomas Jefferson Pumping Station, saves the taxpayers of any municipality real money. In many cases, old pumps, even if as good as when installed, exact at least a 10% power cost penalty. At that rate, new pumps soon pay for themselves.

Comparatively few cities require pumps with such large capacity as Chicago; but large or small, Fairbanks-Morse builds the right pump for the job.

Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago, Illinois.

BUY WAR BONDS

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

F M

Pumps

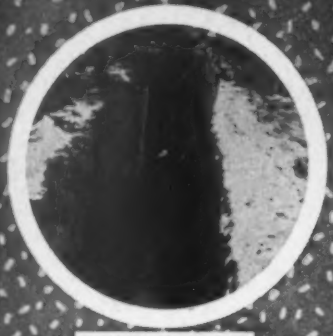
GET YOUR FLOW MEASUREMENT PROBLEMS "BY THE THROAT"

Interchangeability of the throat portion is a distinctive characteristic of the BUILDERS Herschel Standard Venturi Meter Tubes. Since the measuring range is determined by the diameter of the throat, it is possible to change the capacity at small expense by substituting a new throat section, an important consideration in postwar planning for future extensions or increased output. The Totalizing-Indicating-Recording Instrument is altered easily by the substitution of new dials. Ask for Bulletin 143-A. Builders-Providence, Inc., (division of Builders Iron Foundry), 9 Codding Street, Providence 1, R. I.

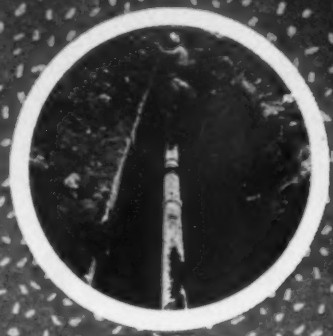
Sincerely Yours,

BUILDERS
RECORDING INDICATING CONTROLLING
Instruments

BUILDERS-PROVIDENCE



WASHINGTON



NEW YORK

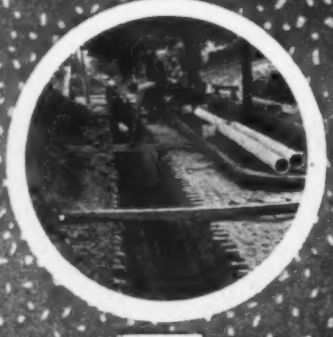
MISSOURI

CALIFORNIA

ARIZONA

TEXAS

ARKANSAS



OHIO

NORTH CAROLINA

Cross-Section Underground

If you were to cut a cross-section out of the water and sewer lines running through the nation's communities, you would find many, many more J-M Transite Pipe installations than we have room for here.

In fact you'd find thousands of J-M installations throughout the United States, and hundreds more in our military camps and bases all over the world where the unique advantages of J-M Transite Pipe are providing efficient, economical water transportation. Note these features:

RAPID ASSEMBLY . . . TIGHT, FLEXIBLE JOINTS. Even unskilled crews can form tight joints easily and quickly with the Simplex Coupling. Wide sweeps can be made with straight lengths as the Simplex Coupling stays tight even when the line is deflected as much as 5° at each joint.

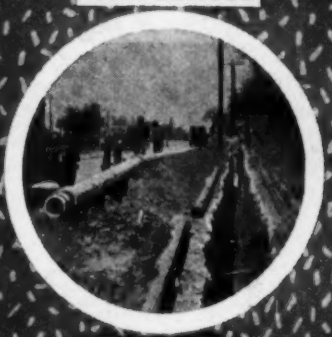
EASY HANDLING. Light-weight Transite Pipe requires fewer men for handling. Only the larger sizes need mechanical handling equipment.

TUBERCULATION NO PROBLEM. Non-metallic in composition, Transite cannot tuberculate. Its initial high flow-coefficient (C-140) can never be reduced by tuberculation.

of the Nation's Waterways

LOW MAINTENANCE. Made of asbestos-cement, Transite's inherent corrosion-resistance and maintained strength contribute to its low maintenance costs.

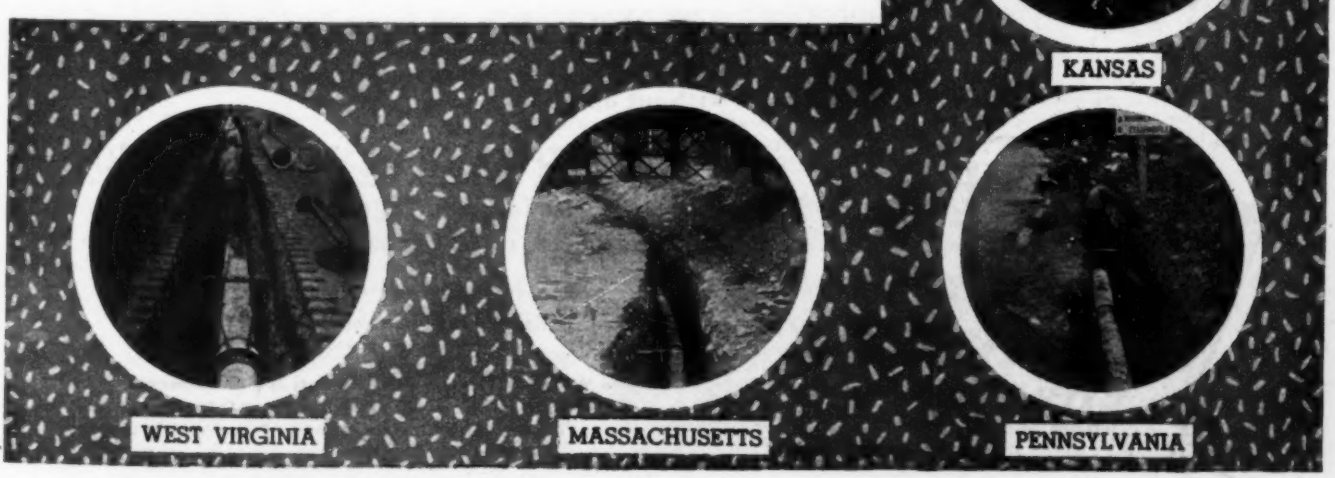
Transite Pipe is available for both military and essential civilian needs. Get the complete facts today by writing for Transite Pipe Booklet TR-11A. For information on Transite Sewer Pipe for lower cost sewage disposal systems, ask for TR-21A. Address: Johns-Manville, 22 East 40th Street, New York, 16, N. Y.

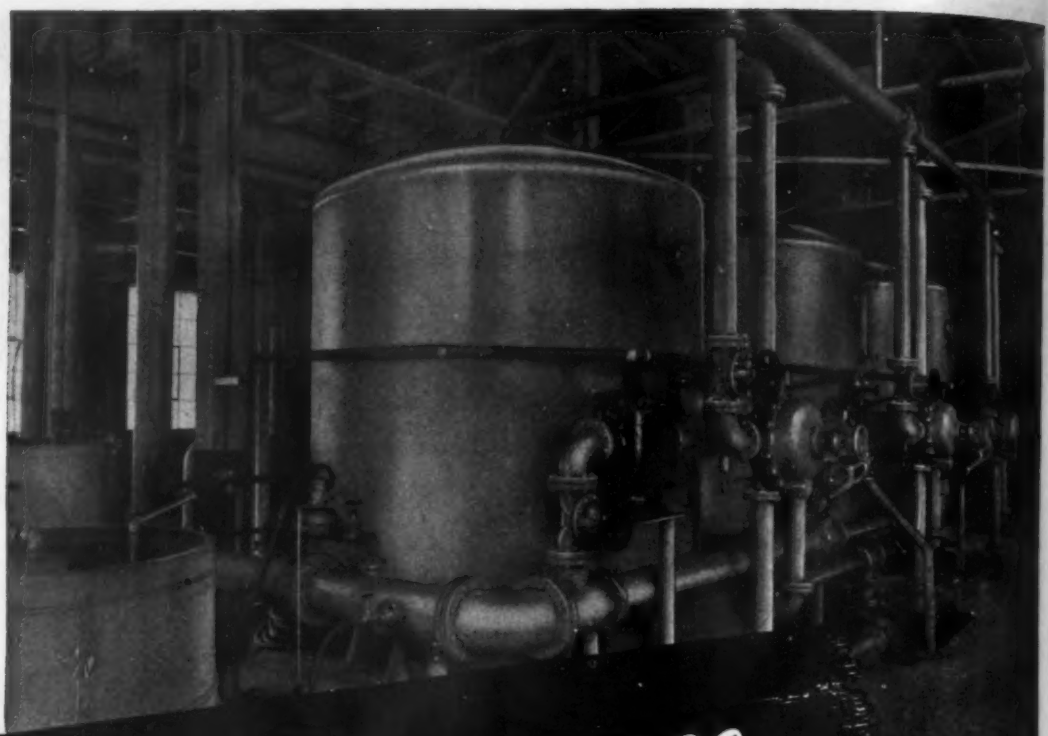


JOHNS-MANVILLE *Asbestos*

JOHNS-MANVILLE JM PRODUCTS **Transite Pipe**

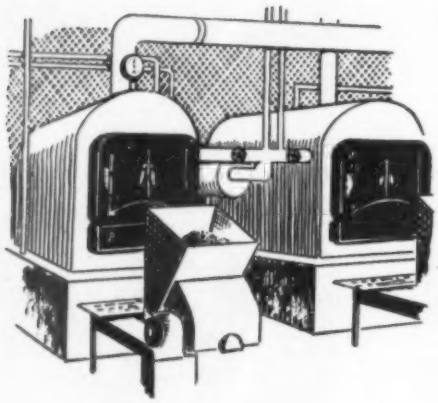
FOR EFFICIENT, ECONOMICAL WATER AND SEWER LINES





Power Insurance

Photograph above shows a Battery of Graver Zeolite Water Softeners.



UNINTERRUPTED POWER is important in any municipal plant. Yet the efficiency of your steam generating unit can be seriously impaired by the use of improperly conditioned boiler feed water.

Hardness in water is caused by the presence of calcium and magnesium salts. These elements cause scale formation on boiler tubes and drums, greatly reducing the heat transfer efficiency of the boiler. And, if this scale is present in any appreciable degree, localized over-heating results, which may cause disastrous boiler failure.

Graver Zeolite Water Softeners prevent this trouble by removing the calcium and magnesium salts from the water supply. They improve boiler efficiency, eliminate frequent shutdowns for tube cleaning, and materially reduce the cost of maintenance and repair.

Whether yours is an immediate need or merely a plan for the future, consult Graver. Our engineers will submit unbiased recommendations and estimates without obligation.

GRAVER

WATER CONDITIONING EQUIPMENT

GRAVER TANK & MFG. CO., INC.

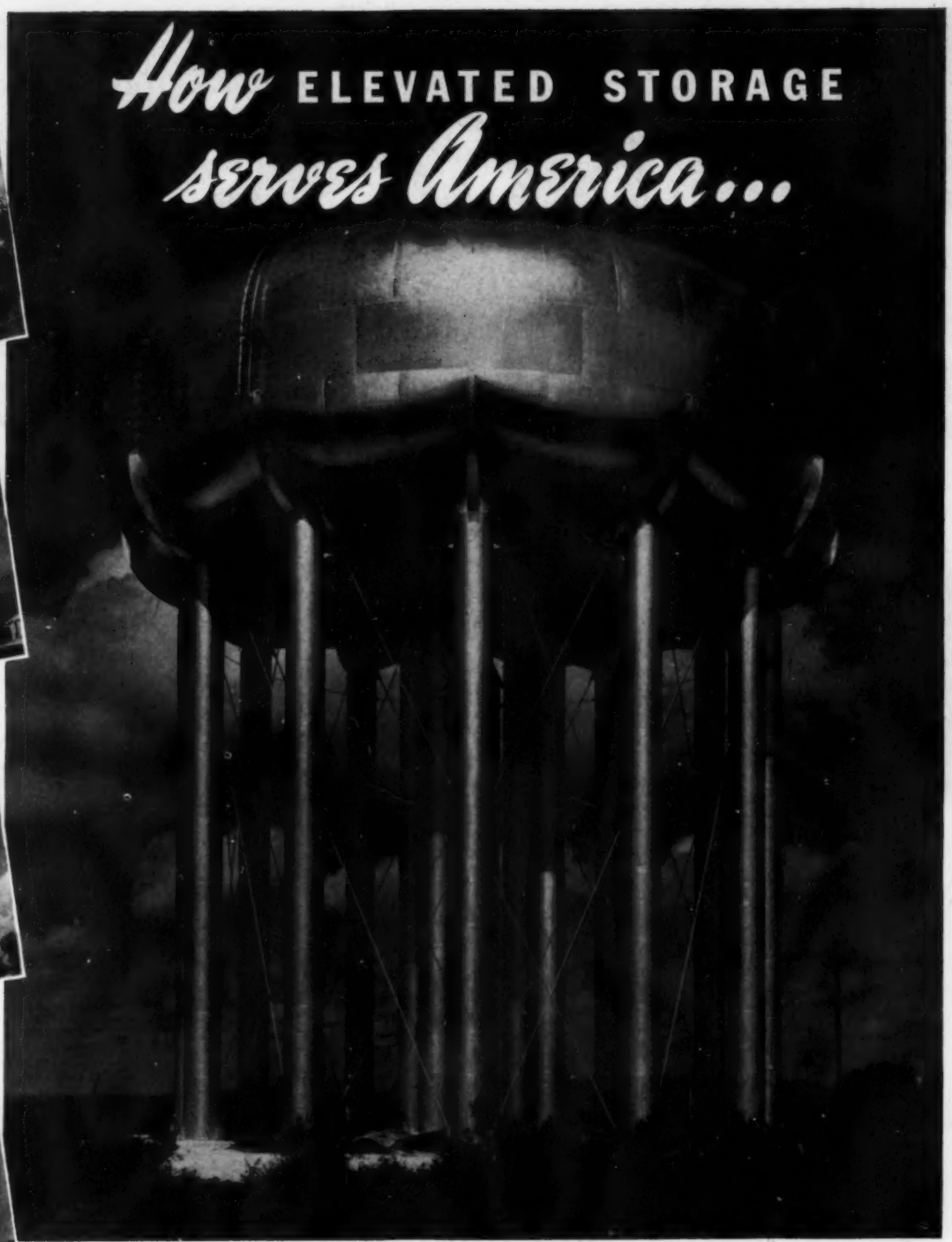
4809-43 Tod Ave., East Chicago, Ind.

NEW YORK CATASAUQUA, PA. CHICAGO TULSA

Graver designs, builds and installs all types of water conditioning equipment including:

Zeolite Water Softeners • Hot Process Water Softeners • Water Filters • Iron Removal Filters • Taste and Odor Removal Filters Oil Removal Filters • Sewage Treatment Equipment

How ELEVATED STORAGE serves America...



One of the two 1,500,000-gal. radial-cone bottom tanks at Indianapolis, Ind.

Watersphere of 100,000-gal. capacity, 60 ft. to bottom, at Longmont, Col.

A 50,000-gal. ellipsoidal-bottom tank installed at Montrose, Minn.

(Above) 400,000-gal. tank at Olney, Ill. Large picture is 1,500,000 radial-cone tank, 75 ft. to bottom, at San Antonio, Tex.

- provides for pumping during off-peak periods.
- assures uniform distribution pressures.
- lowers pumping costs and improves service.
- increases protection against fire hazard.

War activity and shifting populations have increased the demands on water supply systems. Proper maintenance of elevated tanks will help guard a municipality's water supply. Write our nearest office for pamphlet on the care and painting of elevated steel tanks as recommended by the A.W.W.A.

ARMY E NAVY

Eureka, Calif., Yard.
Seneca, Ill., Shipyard.
Newburgh, N. Y., Yard.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Havana .....402 Edificio Abreu
Birmingham 1.....1586 North 50th Street

Tulsa 3.....1648 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut St.
Washington 5.....330 Bowen Bldg.
San Francisco 5.....1083 Rialto Bldg.

"Fox Hole" in the U.S.A.

The "fox holes" on the fighting fronts have their counterparts in the U.S.A. For here, too, determined men are busy keeping the home front in condition for top production. The municipal water supply must be kept uncontaminated to protect manpower against epidemics. It must be abundant and ready against the threat of destructive fires. The waterworks engineer and his staff are alert to these dangers and are constantly strengthening their defenses.

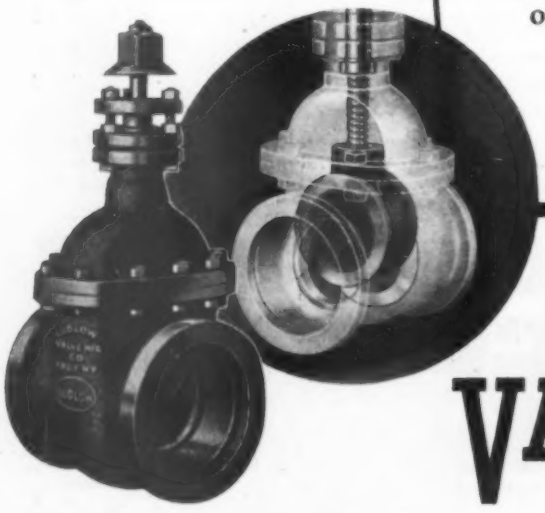
Ludlow Valves are important links in the efficient waterworks system. In gate houses, power and pumping plants, and along the mains, they are giving the smooth operation and trouble-free service that has made them preferred for nearly 80 years.

Ludlow stands ready to advise and cooperate in the matter of priorities. We are as ever willing to give all possible aid to waterworks departments in the solution of their problems.

V-7

THE LUDLOW VALVE MFG. CO., INC.
TROY, N. Y.

LUDLOW VALVE CONSTRUCTION: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth action, tight closure, long service regardless of frequency of use. Rings cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide free movement. Simple construction permits easy replacement of parts.



LUDLOW VALVES AND HYDRANTS

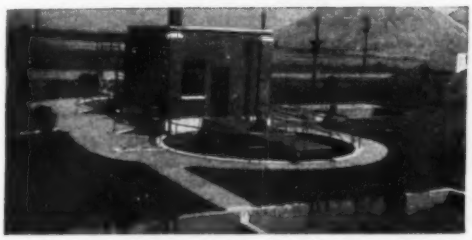
SINCE 1866

Facts

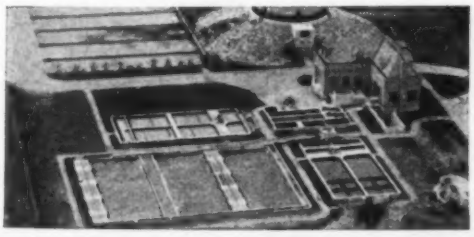
91% to 99%
B. O. D. REDUCTION
AT
REPRESENTATIVE
"CHICAGO"-EQUIPPED ACTIVATED SLUDGE PLANTS

Summary of 1942 Operating Records

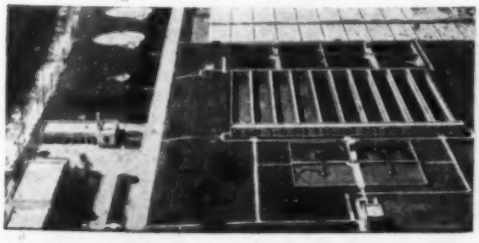
City	Plant Superintendent	Design Sewage Flow M.G.D.	5 Day B.O.D.-p.p.m.			Suspended Solids-p.p.m.		
			Raw Sewage	Final Effluent	Per Cent Reduction	Raw Sewage	Final Effluent	Per Cent Reduction
Aviation Field 1	Post Engineer	0.066	191	18	91	214	10	95
Aviation Field 2	Post Engineer	0.066	244	5	98	312	16	99
Belvidere, Ill.	Miles Lamb	1.180	203	3	99	285	2	89
Bryan, Ohio	C. D. Decker	0.864	113	8	93	121	13	99
Canton, Ill.	R. Johnson	1.150	201	7	97	298	2	97
Gary, Ind.	W. W. Mathews	40.000	132	7	94	228	6	95
Ladd, Ill.	Myron Tenari	0.145	339	17	95	192	9	97
Lake Charles, La.	S. S. Crawford	1.100	211	13	94	285	8	95
Marion, Ind.	D. Backmeyer	4.000	228	13	94	287	14	95
Waterloo, Ill.	E. H. Wolf	0.250	216	40	98	197	1	97
Zeeland, Mich.	R. B. Boukema	0.600	308	14	95	129	4	



0.145 M.G.D.—Ladd, Ill., plant. Charles DeLeuw & Co., engineers. "Chicago" Combination Aerator-Clarifier. See operating data.



0.900 M.G.D.—Celina, Ohio, plant. Paul A. Uhlmann, engineer. "Chicago" Air Diffusion System with Swing Diffusers.



40 M.G.D.—Gary, Ind., plant. Alvord, Burdick & Howson, engineers. "Chicago" Air Diffusion System with Stationary Diffusers. See operating data.

SMALL • MEDIUM • LARGE

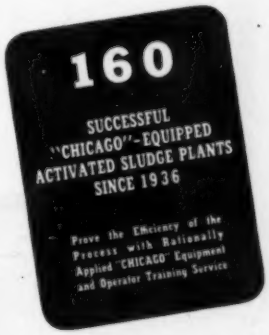
The above data was furnished by the plant superintendents. Copies of their original plant operating records are on file at Chicago Pump Company.

These records show that "Chicago"-equipped Activated Sludge Plants produce the highest degree of purification. Small, medium and large plants are represented—taken at random from among 160 plants having "Chicago" Air Diffusion Systems with Swing Diffusers or Stationary Diffusers, Combination Aerator-Clarifiers or Mechanical Aerators.

Operator Training Service

Our Operating Sanitary Engineers with definite knowledge of process control and plant regulation, BASED ON 10 YEARS' EXPERIENCE, train the plant operator to produce a consistently high degree of purification under widely varying sewage flows and strengths.

SEND FOR LITERATURE ON THE ACTIVATED SLUDGE PROCESS



CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Electric Pumps: Circulating, Bilge, Scru-Peller, Flush-Kleen, Plunger, Fire, House, Condensation, Vacuum.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

HOW TO WRITE YOUR SPECIFICATIONS EASILY

Today in the water works and sewerage field the cry is "Blueprint Now!" Drawing up specifications for a post-war project usually is a problem whether it be for a $10,000 or a $500,000 job. But there is one way to make the task much simpler. If you need ten 16" shear gates, specify MUELLER-COLUMBIAN. If you need twelve size 36 sluice gates, specify MUELLER-COLUMBIAN. If it is gate valves, floor stands, mud valves, foot valves, or any other water control equipment that you desire, specify MUELLER-COLUMBIAN.

For MUELLER-COLUMBIAN builds stock designs that are standardized and interchangeable. This saves on initial cost. (However, if your needs call for special designs or odd sizes, we can make them, too.) When you say "MUELLER-COLUMBIAN" you can be sure that each item is a sensibly engineered product that is honestly built. This guarantees long-term performance with a minimum of maintenance. This saves on upkeep cost. You don't have to take our word for it. Any user of MUELLER-COLUMBIAN equipment will gladly tell you of the satisfactory performance of hundreds of installations.

Another valuable aid for you is our engineering department. Specialists in your field, these men can save a lot of time and preliminary expense by helping you get the right equipment, the right sizes, and the right costs. No charge at all for estimates, specifications, or expert counsel. Write us today.

Have you bought a War Bond lately?

MUELLER CO., CHATTANOOGA 1, TENN.

Founded 1857

A-26006
CHECK VALVE

A-25601 MUD VALVE.

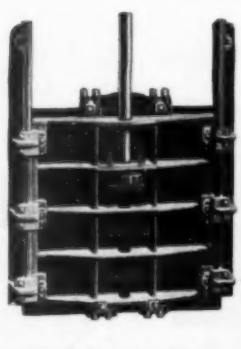
A-26426
INDICATING
FLOOR STAND

A-25146
O. S. & Y.
FLANGED
ENDS

A-26026
FOOT VALVE

A-25400
FLAP VALVE

A-25208
SHEAR GATE



RECTANGULAR
SLUICE GATE

GATEWAY TO PROGRESS

In early times, the Old Fort at Niagara was a strategic portal to the vast unexplored West. Scene of many historic episodes, this outpost was a landmark in man's pioneering quest for a new and better world.

Yet the modern Niagara area is an even greater tribute to the efforts of the pioneers. For it is today one of the great industrial areas of the world. Built up by later generations of pioneers in manufacturing and hydro-electric power derived from the Falls, it is the source of tremendous quantities of chemicals and other important materials with which the America of today is defending the freedom of men throughout the world. As a leading chemical manufacturer in this area, Niagara Alkali Company is using all of its long and valuable experience and modern production facilities to increase the volume and improve the quality of such vital materials.

•

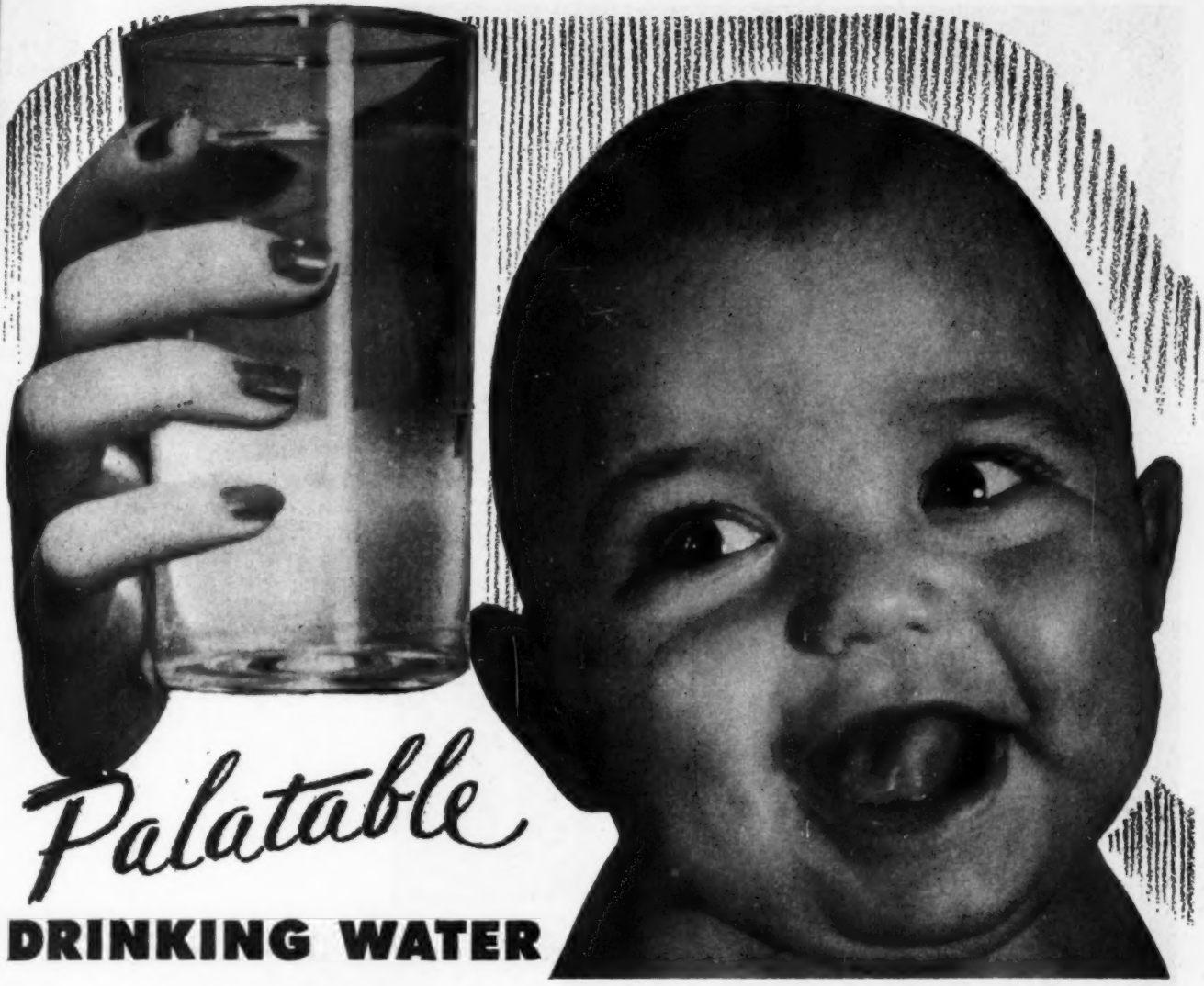
CAUSTIC POTASH · CAUSTIC SODA · PARADICHLOROBENZENE
CARBONATE OF POTASH · LIQUID CHLORINE

An Essential Part Of America's Great Chemical Enterprise

ARMY E NAVY

Niagara ALKALI COMPANY

60 EAST 42nd STREET, NEW YORK 17, N. Y.



Palatable DRINKING WATER

. . . . FOR AN UP AND COMING CITIZEN

Water Works Officials know that Aqua Nuchar Activated Carbon will adsorb unwanted tastes and odors. Yes, over 1,200 American cities have used Aqua Nuchar to assure the delivery of palatable drinking water to the taps of their consumers. If yours is one of the few cities not using this accepted water treatment, send for a generous sample today. Every citizen in your town, regardless of age or station, expects you to provide palatable drinking water—water that is free from disagreeable taste or odor. Foresighted Water Works Officials everywhere use the best equipment and chemicals obtainable to assure not only a *safe* drinking water, but also a *pleasant-tasting* drinking water. That is why Aqua Nuchar Activated Carbon has gained such popularity in the water field.

BLUEPRINT NOW!
But above all, remember there is a war yet to be won. Maintain equipment to assure operation at 100% efficiency.

NUCHAR

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP & PAPER COMPANY

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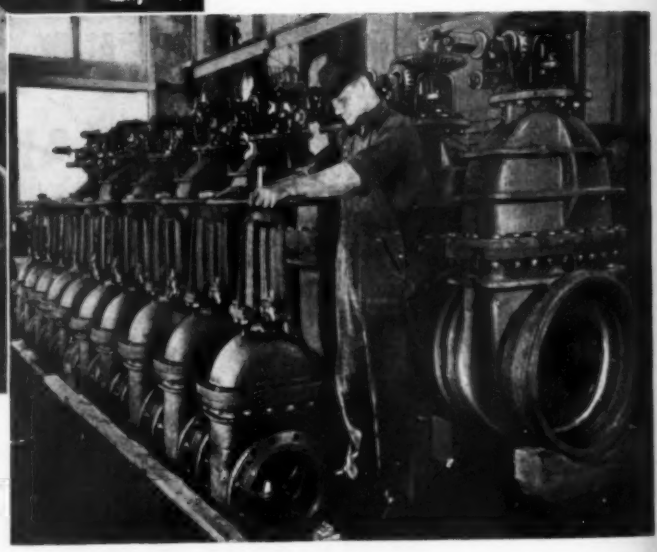
City engineer watches disc of National 24" water main valve slide smoothly into place.

BRUTES IN SIZE . . . BUT JEWELS OF PRECISION MANUFACTURE

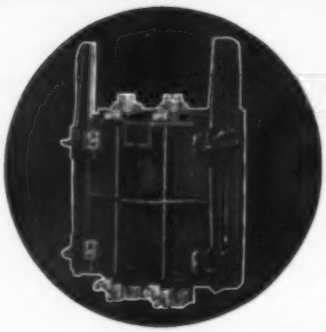
National Gate Valves look husky and they *are* husky . . . built to take it under any and all conditions of service. Equally important, under their massive construction is the precise, meticulous workmanship which means smooth-as-velvet operation.

You'll find National Valves in the water mains of cities large and small, sharing responsibility in the vital job of supplying water to millions. You'll find them in the pipe lines of gas utilities . . . and at sea, controlling the steam which keeps ships moving.

If the gate valve you want isn't among National standard patterns or sizes, we'll design and build to your specifications. Estimates and engineering counsel cheerfully given. Write for information and literature.



National Valves for duty on land and sea. In front row, steel valves for high pressure steam lines on Henry Kaiser's ships. Behind them, 24" valves for Chicago water mains.



NATIONAL SLUICE GATES

Modern gates for modern sewage disposal plants. Heavy over-size construction, backed-up by careful machining and fitting of all sliding or screw parts. Wherever corrosive action might affect operation, only bronze is employed.

NATIONAL
MACHINE WORKS
1559 N. Sheffield Ave. Chicago 22, Ill.

Maintaining efficient sewage treatment to guard health on the home front as well as in military establishments is also a job for us who produce chemicals. Here at HOOKER this responsibility is never forgotten. Even with our enlarged facilities working at top capacity, standards of quality are kept ever in mind. In war as in peace, you can rely on the quality of HOOKER Chemicals.

HOOKER

BLEACHING POWDER
CAUSTIC SODA
CHLORINE
FERRIC CHLORIDE SOLUTION

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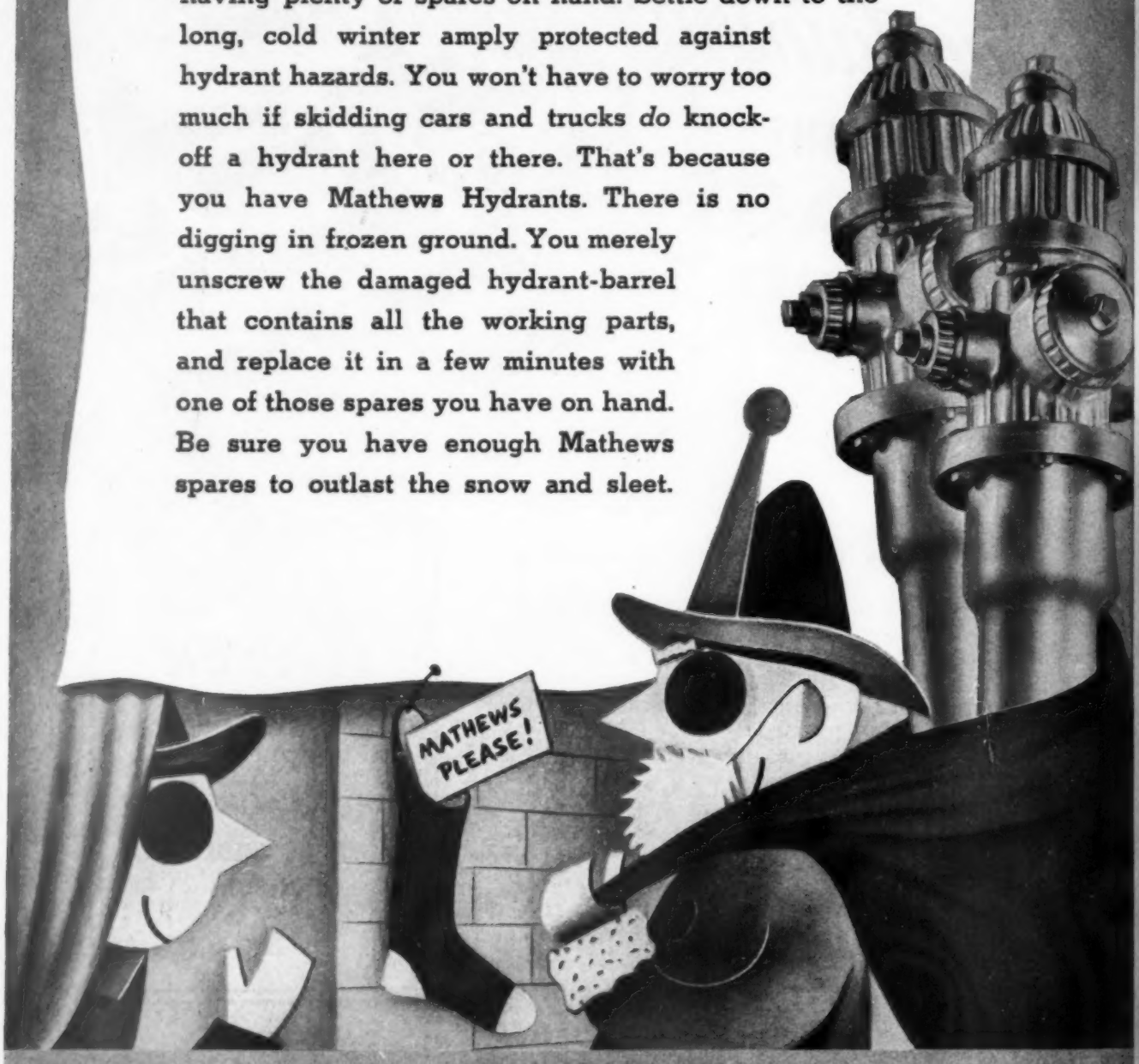
ARMY E NAVY
HOOKER ELECTROCHEMICAL COMPANY

HOOKER CHEMICALS

4043

WINTER TIME IS "STOCKING" TIME

Give yourself the peace-of-mind that comes with having plenty of spares on hand. Settle down to the long, cold winter amply protected against hydrant hazards. You won't have to worry too much if skidding cars and trucks *do* knock-off a hydrant here or there. That's because you have Mathews Hydrants. There is no digging in frozen ground. You merely unscrew the damaged hydrant-barrel that contains all the working parts, and replace it in a few minutes with one of those spares you have on hand. Be sure you have enough Mathews spares to outlast the snow and sleet.



MATHEWS HYDRANTS

400 CHESTNUT STREET, PHILADELPHIA, PA.

ESTABLISHED IN 1803

Made by R.D. WOOD Company

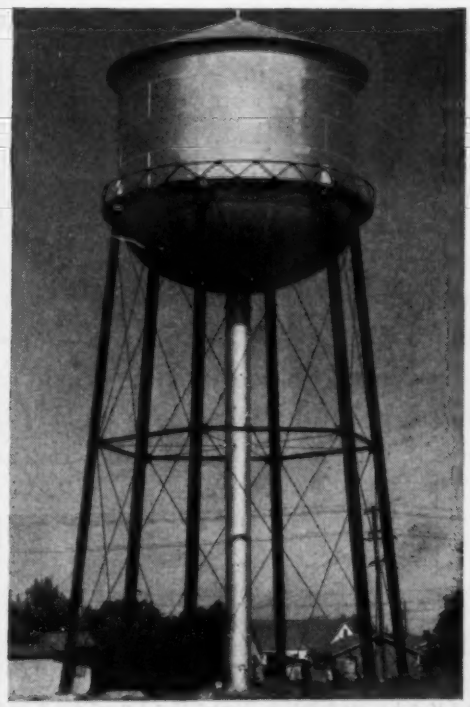
MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

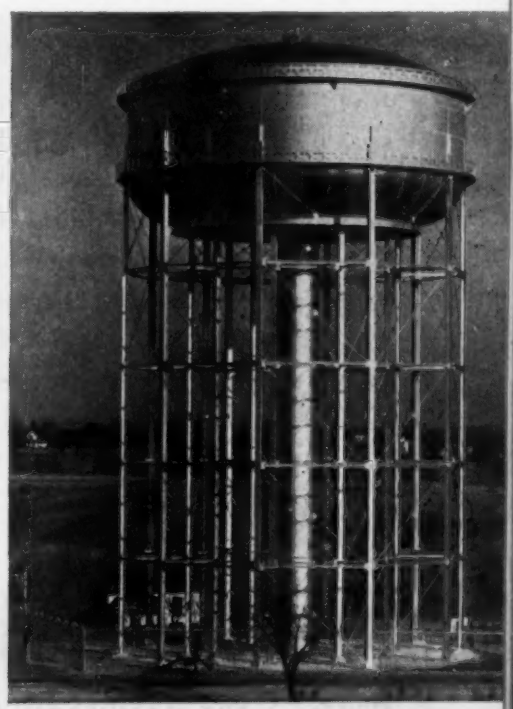
After the WAR..

PITTSBURGH •DES MOINES *Elevated* STEEL TANKS...

Will definitely help to raise the Living Standard of YOUR Community!

Making your town *a better place to live in* is a vital post-wa objective, to be met by present planning. • Better water servic with Pittsburgh-Des Moines Elevated Tanks guards health lowers operating costs, improves fire protection, and adds t the permanent assets of your municipality—facts which we wil be glad to discuss with you at your convenience.





PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, P.A. 3418 NEVILLE ISLAND • DES MOINES, IOWA, 919 TUTTLE STREET
NEW YORK, ROOM 918, 270 BROADWAY • CHICAGO, 1222 FIRST NATIONAL BANK BUILDING
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SEATTLE, 1126 EIGHTH AVENUE, SOUTH

Ernie Pyle, *FAMED WAR CORRESPONDENT,* finds pure water vital to our fighting men

ERNIE PYLE, FAMED SCRIPPS-HOWARD WAR CORRESPONDENT

". . . you could almost say an army marches on its water," wrote Ernie Pyle in a recent dispatch from the Mediterranean front. "When a water point is found, the engineers wheel in their portable purifying unit. This consists of a motorized pump, and sand filter, chlorinating machine and a collapsible 3,000-gallon canvas tank. The chlorine we inject comes in powder form in 1 gallon cans—we usually use 1 part of chlorine to a million parts of water. The engineers of the 45th Division brought with them enough chlorine to last 6 months. In addition to chlorine, alum and soda ash are injected into the water."

THAT "chlorine in powder form" Ernie Pyle speaks of is, of course, high-test calcium hypochlorite and, as likely as not, it's Mathieson Sanitation HTH. For Sanitation HTH is doing a big war job these days. It's moving right up to the fighting fronts all over the world helping to protect the health of our armed forces.

Our boys, naturally, have first call on Sanitation HTH, but sufficient supplies continue to be available to meet essential civilian needs, such as municipal water treatment. Many communities throughout the country have come to depend upon HTH for regular chlorinating jobs as well as for many special and emergency jobs that arise from time to time. Containing 70% available chlorine in a stable, quickly-soluble granular form, Sanitation HTH is a mobile chlorine carrier admirably adapted for many uses on both the fighting and home fronts.

Write today for information on Sanitation HTH.

MATHIESON Sanitation HTH

THE MATHIESON ALKALI WORKS (INC.), 60 EAST 42nd STREET, NEW YORK, N. Y.

LIQUID CHLORINE . . . SANITATION HTH . . . HTH BLEACH . . . SODA ASH . . . CAUSTIC SODA . . . BICARBONATE OF SODA . . . AMMONIA, ANHYDROUS and AQUA . . . PH-PLUS (FUSED ALKALI) . . . DRY ICE . . . CARBONIC GAS . . . SYNTHETIC SALT CAKE . . . SODIUM CHLORITE PRODUCTS

A PIPELINE THAT WON'T STAY BOMBED OUT!

It bends with the blast of near misses as illustrated in the training picture you see here. At the battle front when sections are destroyed by direct hits or by big bombs hitting nearby, new pipe can be laid and coupled in a matter of minutes. The reason? The couplings of thousands of miles of the Blitz pipelines, that are helping make rapid troop advances possible, *are Victaulic.* Add up the 5 basic Victaulic advantages and you'll see why the Victaulic method of coupling pipe is not only faster but better at home, too.

(1) Fast Self-Aligning permits angular deflection!

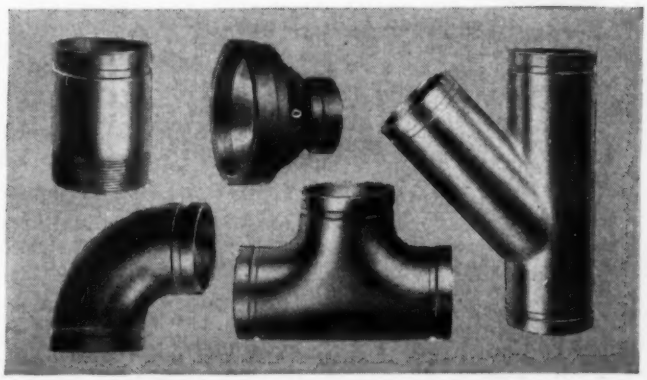
(2) Leak-tight, self-sealing under pressure or vacuum!

(3) Positive mechanical lock of pipe lengths!

(4) Every joint is a pipe union!

(5) Every joint an expansion joint!

SAVES MONEY IN INSTALLATION AND MAINTENANCE! For 20 years Victaulic Couplings have been specified by Municipal Engineers for power plants, water storage and supply, gas, sewerage, fire protection, emergency line and other pipe installations. Unskilled labor can handle the installation. Only a small wrench is needed. Maintenance is nil.



VICTAULIC FULL-FLOW FITTINGS eliminate the tedious work of ordinary pipe fitting. Long easy sweeps and smooth true-circular walls reduce friction losses. A real contribution to speed and ease of installation and greater efficiency in conducting fluids and gases in pipe systems!

BUY MORE WAR BONDS!

MUNICIPAL

VICTAULIC

SELF-ALIGNING PIPE COUPLINGS AND FULL-FLOW FITTINGS

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Now on the presses . . . a new easy-to-use Victaulic Catalog and Engineering Manual. If you haven't already reserved your copy, do so now.

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Mail to nearest address: VICTAULIC COMPANY OF AMERICA, 30 Rockefeller Plaza, New York 20, N. Y.; Victaulic Inc., 727 West 7th St., Los Angeles 14, California; Victaulic Co. of Canada, Ltd. 200 Bay St., Toronto. 3-G

Cost of Manganese Removal Cut from $7.27 to $4.76 per M.G. with Ferrisul

Faced with wartime shortages of chemicals previously used to solve its chronic "black water" troubles, a water plant in a town of sixty thousand recently turned to Ferrisul . . . and thereby *improved* manganese removal at the same time it *reduced* total treating costs from $7.27 to $4.76 per M.G.!

Such results are typical when Ferrisul (anhydrous ferric sulfate) is used to solve the otherwise difficult problem of manganese removal from soft, impounded waters.

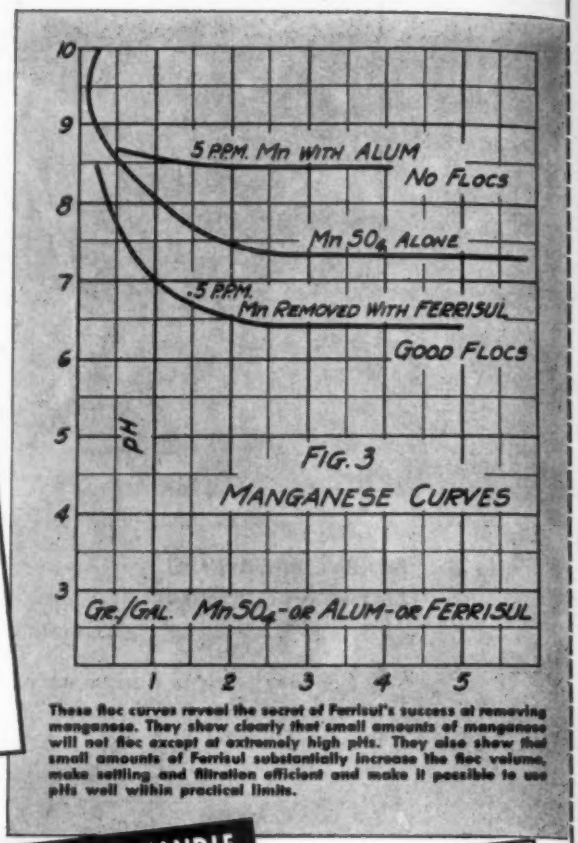


FIG. 3
MANGANESE CURVES

These floc curves reveal the secret of Ferrisul's success at removing manganese. They show clearly that small amounts of manganese will not floc except at extremely high pHs. They also show that small amounts of Ferrisul substantially increase the floc volume, make settling and filtration efficient and make it possible to use pHs well within practical limits.

WHY FERRISUL IS EFFECTIVE

To precipitate manganese, frequently present in solution in the manganous state when oxygen content is low, it must first be oxidized to the manganic condition — and four facts about Ferrisul make it the ideal agent for this specialized job.

1. Ferrisul has a mild oxidizing action.
2. It is an efficient coagulant at the pH required to speed oxidizing.
3. It forms a dense floc which absorbs the precipitated manganic oxide.
4. It produces water of lower residual manganese content than any other process now known.

HOW FERRISUL IS USED

The prescribed dosage calls for eight to twenty-five parts per million of Ferrisul plus lime to yield a pH of 9.0 or slightly lower. While the exact dosage varies with individual waters, the pH of treatment is relatively constant and is usually very close to the proper pH of stabilization, thus eliminating the need for pH correction in the clear well.

The cost of treatment is comparable with average treating costs and considerably less than that of other methods for this special treatment. The reductions in total chemical costs cited above were made despite a need for the maximum dosage of twenty-five p.p.m. Ferrisul.

EASY TO STORE, HANDLE

Ferrisul is a free-flowing, granular product which is easy to store, handle and introduce into the treatment. It can be transferred on any standard conveyor system and introduced either by dry feeding or in solution. For example, the plant mentioned above was equipped to handle and feed Ferrisul efficiently at a total equipment cost of only $150.

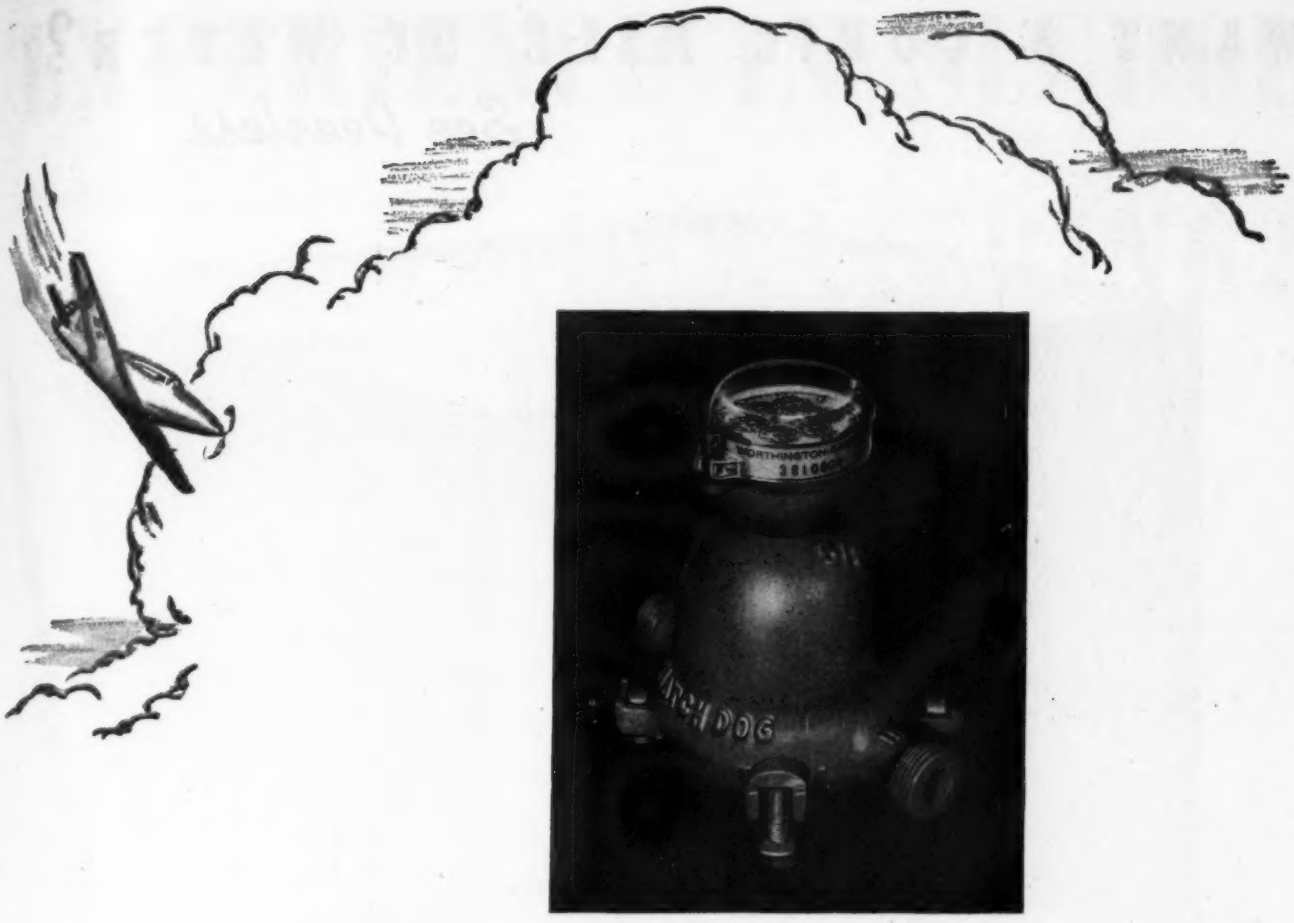
The only anhydrous ferric sulfate available commercially, Ferrisul remains dry and free-flowing in storage. One sixty-ton lot, for example, which has been stored in a steel bin for five years, was recently found to be as dry and easy to handle as the day it was delivered.

OTHER PROBLEMS SOLVED

Manganese removal is just one of scores of water and sewage treating problems to which Ferrisul provides a simple, economical solution. For details and experienced technical advice on *your* particular problems, write: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston 49, Mass.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

Ferrisul



BRONZE METER CASES HAVE GONE TO WAR

Yes! We continue to manufacture Water Meters, with Army, Navy and Maritime Commission taking preference.

Of course, we are operating under WPB Limitation Order L-154 to conserve copper, and must use substitutions for certain critical materials. That is why Worthington-Gamon Household Meters now come to you with iron casings and glass register boxes.

However the Limitation Order does not affect the interior parts. Therefore the materials in the gear train and measuring chamber remain unchanged.

Accuracy is assured by maintaining the same rigid manufacturing standards as in the past . . . and all parts are interchangeable with your other Worthington-Gamon Meters.

WATCH DOG

WATER METERS

WORTHINGTON-GAMON METER COMPANY

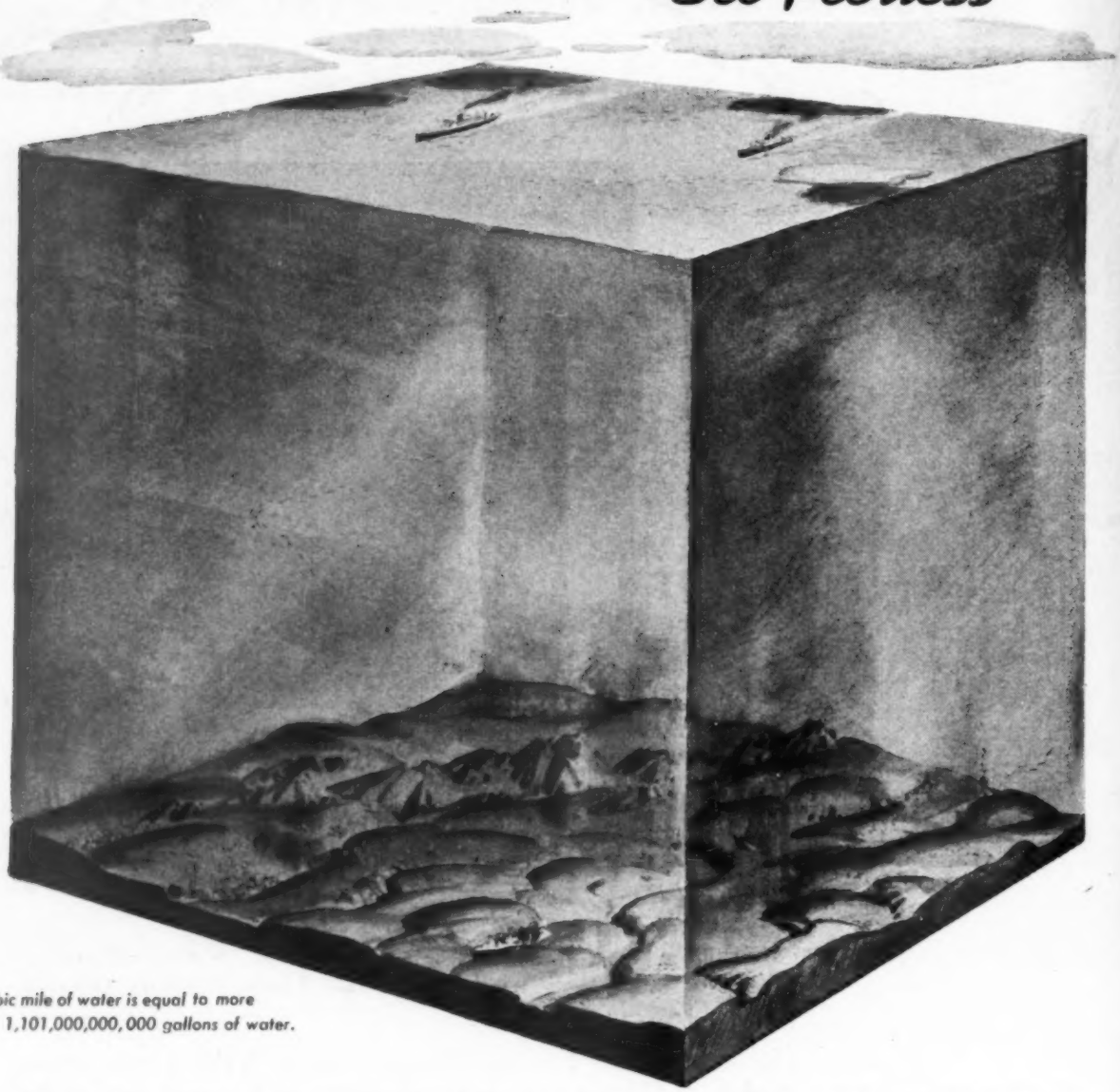
282-296 SOUTH STREET NEWARK, NEW JERSEY

WG3-3

WORTHINGTON-GAMON

WANT A CUBIC MILE OF WATER?*

-See Peerless

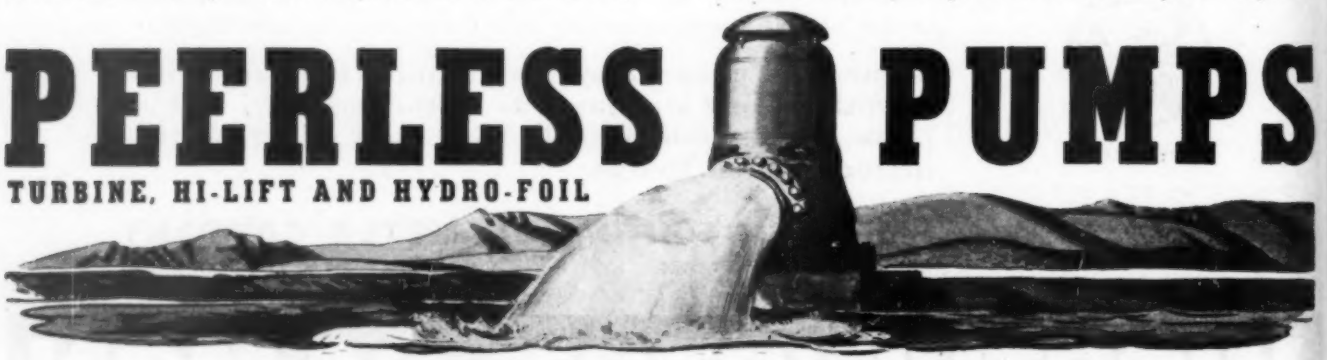


*A cubic mile of water is equal to more than 1,101,000,000,000 gallons of water.

That's a fantastic amount of water—more than eleven hundred billion gallons–but ten giant Peerless Hydro-Foil Pumps could do this job. Maybe you only need 10 gallons a minute. There's a Peerless Hi-Lift Pump that will produce this amount, too. So, regardless of the capacity of water you need, Peerless has a pump for the job. Peerless Pumps are made in a variety of types, with oil or water lubrication and any power drive to pump water from any depth. Literature upon request.

PEERLESS PUMPS

TURBINE, HI-LIFT AND HYDRO-FOIL



PEERLESS PUMP DIVISION *of* ***Food Machinery Corporation***

FACTORIES: CANTON, OHIO; LOS ANGELES, SAN JOSE, FRESNO, CALIF. Service Offices and Sales Agents in Principal Cities.

EXPERIENCE IN SLUDGE DEWATERING!

Would you Measure it by...

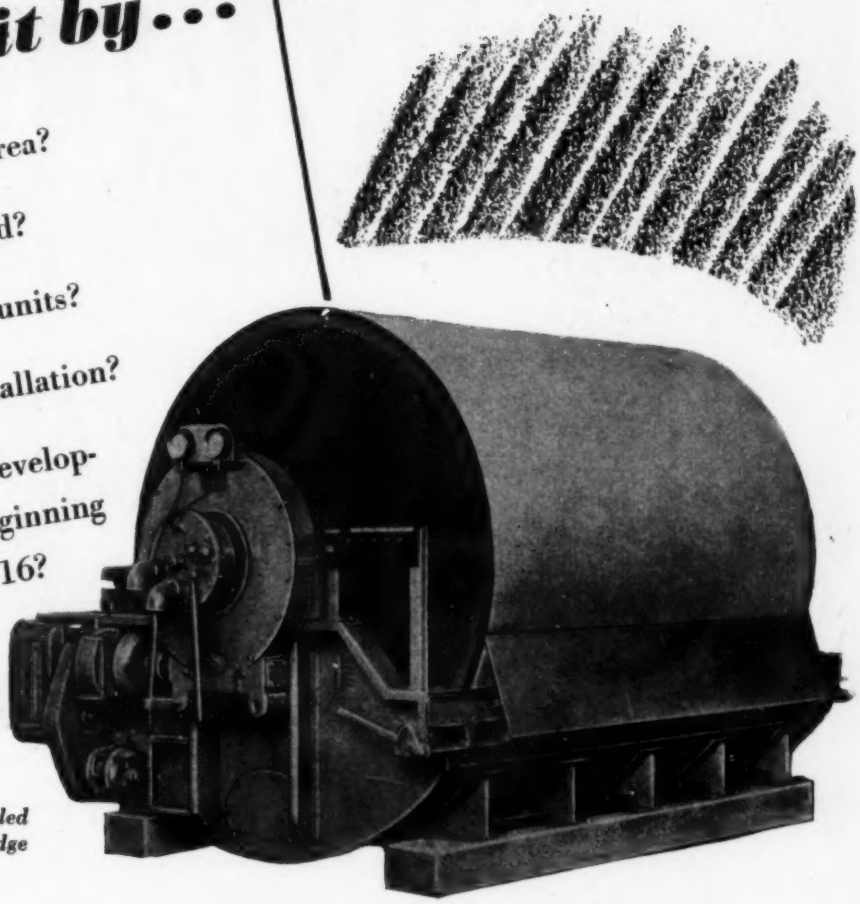
1 . . . highest total filter area?

2 . . . most filters installed?

3 . . . largest individual units?

4 . . . largest single installation?

5 . . . pioneering and developmental work beginning as early as in 1916?



Latest type all-assembled Oliver Continuous Sludge Dewaterer.

If such be your measuring stick then Oliver United *is* EXPERIENCED.

"What of it?" you ask.

Experience shows that experience can give you the best return on the money invested in a continuous vacuum sludge dewaterer. Experience knows how sludge should be conditioned. Experience knows how to tie in all functional details, thus providing high capacity from the start and low cost, trouble free operation. If you want this, you will want an Oliver Sludge Dewaterer.

OLIVER UNITED FILTERS INC.

SALES OFFICES

33 W. 42nd St., New York 18, N. Y.
221 N. LaSalle St., Chicago 1, Ill.

Western Sales Div.

2900 Glascock St., Oakland 1, Calif.
260 California St., San Francisco 11, Calif.

Factories: Hazleton, Pa., Oakland, Calif., Orillia, Ontario, Canada, Melbourne, Australia

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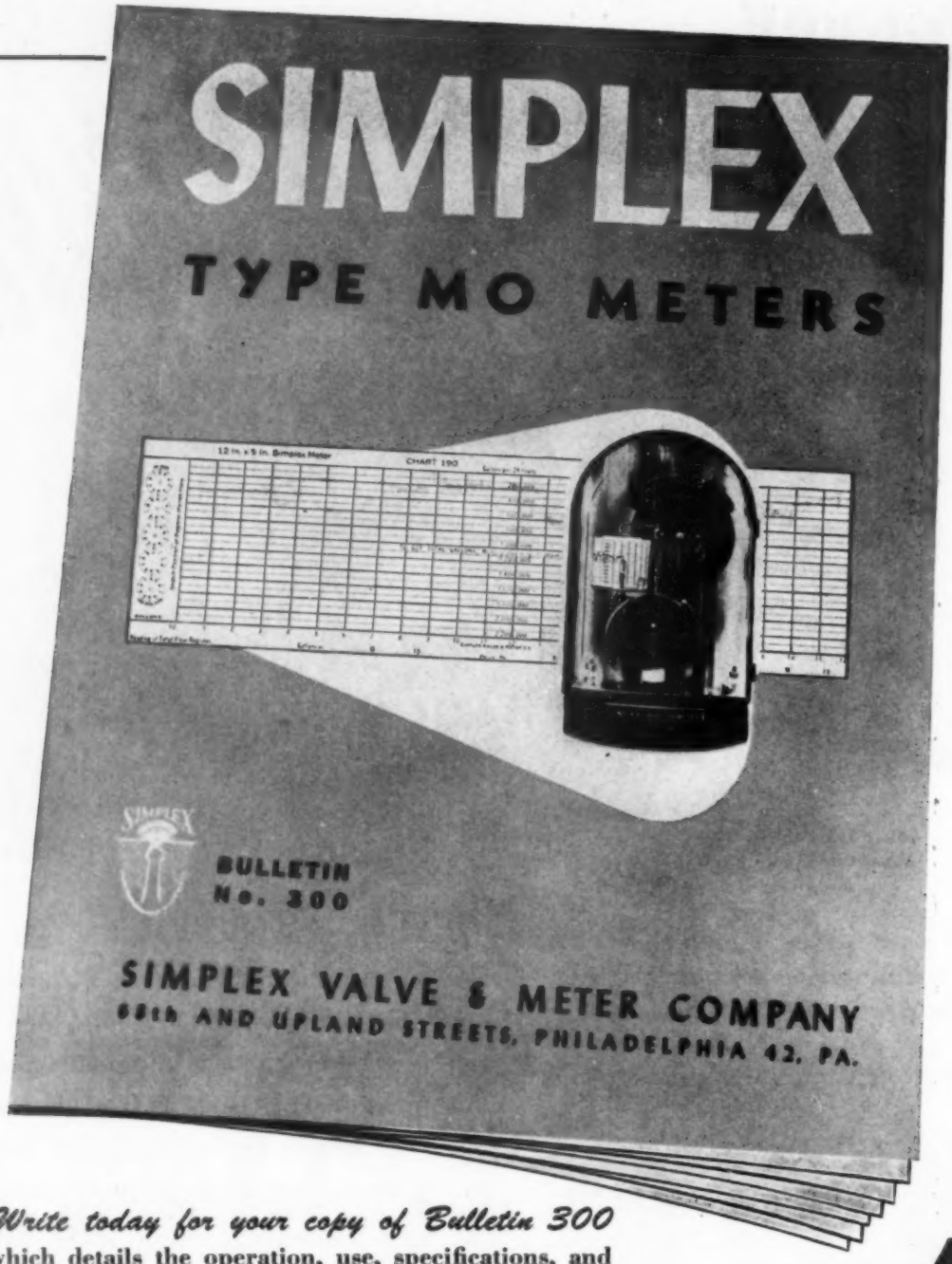
HERE ARE ALL THE FACTS ABOUT THE

SIMPLEX TYPE MO METER

The High-Accuracy Flow Rate Meter



Write today for your copy of Bulletin 300 which details the operation, use, specifications, and accuracy of the Simplex MO flow rate meter. Specified by operating men and management from coast to coast.

SIMPLEX VALVE & METER COMPANY

6743 UPLAND STREET, PHILADELPHIA 42, PA.

You'll recognize instantly the many advantages of the new Yeomans "Rim-Drive" Clarifier Drive for circular settling tanks

- **Motor and drive unit mounted on the rim of the tank.** Does away with costly bridges and walk-ways. Easy to get at.
- **Power applied at the rim.** Full effective use of the lever arm principle—positive engagement on full periphery of plow-blade assembly—cuts torque demand over 95%.
- **No complicated and costly high-torque, high-reduction gears**—A simple worm gear eliminates vertical shafting and bearings.
- **Automatic overload release**—simple, positive, audible or visual alarm—or both.
- **Automatic scum removal,** if specified, with Yeomans "Auto-Skimmer" and "Auto-Flusher."
- **Simple installation, reduced maintenance.** A minimum of working parts gives ample assurance of long life. All parts are easily adjustable for wear.

Keep your data file on clarifiers complete and up-to-the-minute by getting full information on Yeomans "Rim-Drive."

YEOMANS BROTHERS COMPANY

1423 NORTH DAYTON STREET • CHICAGO 22, ILLINOIS

SEND THE COUPON . . . *There's No Obligation . . .*

YEOMANS BROTHERS COMPANY
1423 North Dayton Street • Chicago 22, Illinois

Please send us detail drawings and literature on Yeomans "Rim-Drive" Clarifier mechanism.

Name_____

Address_____

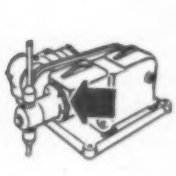
City_____ State_____

HIGH PRESSURE MIDGET
Chem-O-Feeder

For Feeding

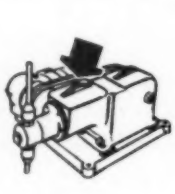
HYPOCHLORITE	LIME SLURRY
ACTIVATED ALUM	SODIUM ALUMINATE
BLACK ALUM	CAUSTIC
FILTER ALUM	FERRIC CHLORIDE
SODA ASH	SULPHURIC ACID
FERROUS SULPHATE	AQUA AMMONIA
FERRIC SULPHATE	ALUMINUM SULPHATE
CALGON	ETC.

With capacity up to 6½ g.p.h. against a maximum pressure of 200 lbs. per sq. in. this plunger type pump can be cross connected to starting switch of water pump for automatic chemical feeding. This set-up requires no attention other than periodic refilling of reagent container.



SEE-THRU REAGENT HEAD

Special plastic head and check valves combined with non corrodible stainless steel plunger make this %Proportioneers% pump ideal for water purification with chemicals listed above.



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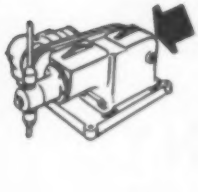

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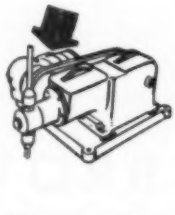

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WATER WORKS & SEWERAGE

PUBLICATION OFFICE
330 South Wells Street, Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

"Water and Sewage Developments of 1943"

As is customary, featured in our January issue will be the annual review of developments of the year and trends in water supply and purification. The reviewer this year is the President of the Am. Water Works Assn.

SAM B. MORRIS,
Dean of Engineering Leland Stanford Univ. Calif.

In our February issue will be featured the annual review of developments and trends in sewerage, sewage and industrial waste treatment. The reviewer is the President of the Federation of Sewage Works Ass'ns.

A. M. RAWN, Gen'l Mgr. & Chief Engr.,
Los Angeles County Sanitation Districts.

Cleaning a Water Main with Compressed Air

Is a brief story telling of the usefulness of compressed air injected into a long force main, while pumping at maximum rate, as a means of breaking loose and flushing out a form of encrustation which gradually builds up to markedly reduce the main capacity and increase pumping costs. The article explains how simple and fool-proof this effective remedy is. The same article also reveals the effectiveness and economy of well desanding with compressed air. This story comes from—

ROSCOE R. HOWARD,
Supt. of Utilities, Slater, Mo.

"Experience with Up-Flow Type Clarification Units"

Relates the findings from studies made of two types of up-flow clarification tanks, in which the sludge blanket contact for speeding chemical reactions and flocculation is a feature. The reporter is—

H. O. HARTUNG, Chemist,
St. Louis County Water Co., University City, Mo.

"Special Sewer Service Charges For Industrial Wastes"

Is an interesting account of how a large city developed through survey and analyses formulae for applications in making charges for sewer service and treatment of waste from several industrial plants connected to the municipal sewer system. First a General Formula was developed and to this is applied the proper factors to arrive at the equitable charge for handling and treating the specific industrial waste. This development constitutes a pioneering effort in the direction of charging industry for treating its wastes on an equitable basis. The authors—

GEORGE E. SYMONS,[1]
FREDERICK W. CRANE,[2]
[1]Former Chief Chemist, and [2]Structural Engineer,
Buffalo (N. Y.) Sewer Authority.

"A Believe It or Not Story"

Tells the recent history of chlorination of a "hard to get along with water," which in itself makes history. The experiences of this small city water superintendent are eye-opening to say the least. They reveal what an inquisitive and experimental minded operator has accomplished in clearing up consumer complaints and so-called "aftergrowths" of gas formers in the distribution system. This "Believe It or Not" story comes from a man who, without benefit of college training, received the Fuller Award for his initiative and leadership in water treatment.

R. GORDON YAXLEY,
Supt. of Water, Waterford, N. Y.

A Speedy Method of Pipe Cutting

Is described and pictured by an engineer who conceived of the idea of driving a good but slow operating pipe cutter with an air compressor driven pneumatic wrench, instead of the customary hand ratchetting operation. Cutting a 12 in. pipe with one man in 17 minutes, instead of in 2 hours with four men, was the accomplishment. The author is—

A. M. EDWARDS, Sr. Engr.,
Division of Water, Columbus, Ohio.

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WATER WORKS & SEWERAGE

VOL. 90, No. 12 *A Gillette Publication* DECEMBER, 1943

THE DISTRIBUTION SYSTEM*

Some Basic Considerations in Its Design, Maintenance and Operation

By L. R. HOWSON
Consulting Engineer
ALVORD, BURDICK & HOWSON
CHICAGO, ILL.

IN ENDEAVORING to appraise the importance of the distribution system in water works practice, I first turned to the Journals of the American Water Works Association, an inspection of which disclosed that there were over twice as many papers relating to water quality and water treatment as there were with reference to the distribution system, including meters, unaccounted for water, hydrants and valves. Probably this is as it should be, for water quality is a matter of life and death;

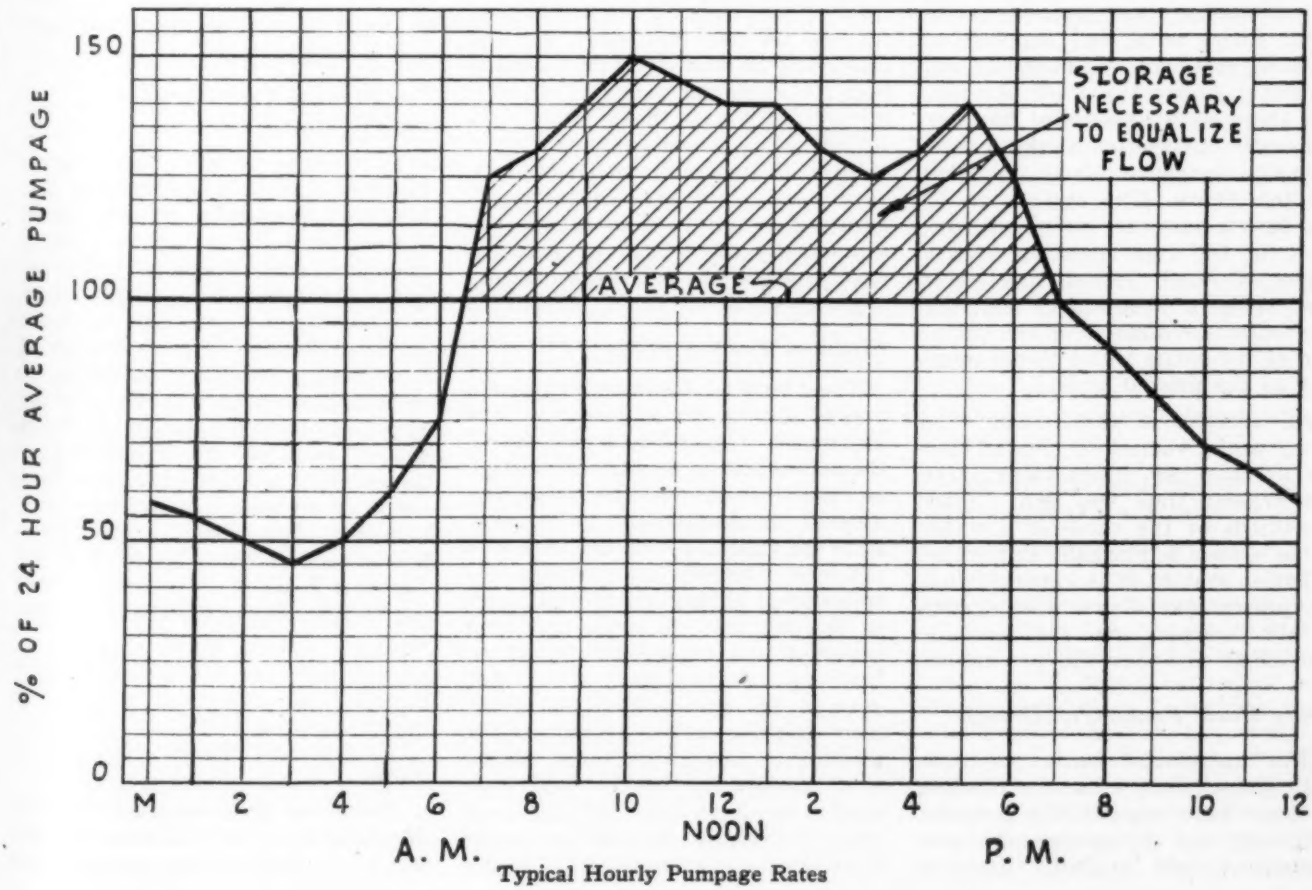
The Author

whereas proper design, operation and maintenance of a distribution system is primarily a question of economics. Undoubtedly this seeming lack of proper consideration for the economics of water supply results from the inability of the various program committees to secure constructive papers on what is generally considered a prosaic subject.

Economic Value of Distribution Systems

As a second step in appraising the economic importance of the water distribution system, the summaries of 16 recent water works appraisals were analyzed. The analyses showed that for these 16 plants the distribution system valuation averaged 66.8 per cent of the total plant value.

*A paper presented before the Wisconsin Section of A.W.W.A., the publication of which has been authorized by the Association.



Typical Hourly Pumpage Rates

While this percentage varied somewhat for individual plants, all but two fell within a range of 20 per cent of this numerical average. The weighted average of the percentage of the distribution value to the total plant value of the 16 plants was 65.3 per cent. It may be roughly stated, therefore, that two-thirds of the total value of the average water works is found in the distribution system. A check of valuations made as remote as thirty years ago shows this ratio to have remained practically constant.

The fact that two-thirds of the value of the ordinary water works is in the distribution system, and that 80 per cent of the distribution system value is in the item of mains and valves, indicates one of the most valuable yardsticks for an approximate indication of the value of a water works property of which there is no detailed inventory available. The length of pipe of the various sizes in the distribution system is always a matter of record and capable of easy conversion into tons. Normally the weight of pipe in a cast-iron distribution system will approximate 275 to 300 tons per thousand population.

Analysis of nine recent water works valuations, most of which involved transfer of ownership, revealed that the value of the entire system per ton of pipe in the distribution system was approximately $200. Cities with well supplies or without treatment will normally fall somewhat under the $200 per ton, and those with impounded supplies and costly purification works will be normally somewhat above the $200 per ton figure. The application of this figure, however, varied with respect to the facts relating to the source of supply in each particular case, will give a convenient and very approximate indication of the valuation of the entire water works property at the present time.

An analysis of these same nine water works valuations showed that the average per capita value as to the present time was $63. Since two-thirds of the value of a water works system is normally in the distribution system, it is apparent that the present-day distribution system in the average city has a value equivalent to about $40 per capita.

Some Basic Factors in Design

Too many distribution systems just grow. Very few distribution systems were scientifically designed originally and through growth, concentration and shifting demands need almost constant checking. The problem of designing an entirely new distribution system is seldom met in practice. The more frequent problem is that of designing a feeder or circulating system to correct deficiencies in capacity resulting from growth, reduction in carrying capacity, or allied causes. The National Board of Fire Underwriters, through periodic tests of distribution systems, has done much to uncover weaknesses and to indicate the requirements for reinforcement.

Every water distribution system supplies two distinct services; namely, the furnishing of normal domestic and industrial requirements and the water required to fight fires.

The former type of service extends more or less continuously over the entire area served. Fire demands are intermittent, concentrated in relatively small areas and of high intensity.

The domestic and industrial needs for water vary from day to day and from hour to hour. Ordinarily the maximum day of the year will be 50 per cent more or less in excess of the average day for the year and, on that maximum day, the peak hour will be 50 per cent more or less above the 24-hour average. Accordingly, the annual peak is approximately 2¼ times the average rate for the year. These percentages are subject to material variations for various cities but are sufficiently accurate for use in illustrating the comparative importance of ordinary and fire demands on the distribution system.

Elevated Tank Storage

The fact that the maximum rates prevail during but a portion of the day makes it possible to provide for them in whole or in part by storage in reservoirs or elevated tanks. Ordinarily, if elevated storage of from 20 to 40 gallons per capita (gpc.) is available, the rate of pumpage can be constant throughout the 24 hours of the day with all peaks met with water drawn from storage. It is, however, not necessary to provide storage in this amount to secure most of the benefits. Storage in the amount of but 25 per cent of the total storage requirement will ordinarily result in lowering the peak rate of pumpage by half its excess over the daily average. This 25 per cent storage provision is equivalent to only 5 to 10 gallons storage per capita.

Elevated tank storage sufficient to completely iron out hourly peaks is not very costly. Assuming 30 gpc. as the storage required in order that the supply and pumping equipment may operate at a uniform rate throughout the 24 hours of the day, the approximate present-day costs would be as follows:

Population	Elevated Tank Capacity	Elevated Tank Cost @ 12c/lb.	% Tank Cost to Value of Distr. System
5,000	150,000	18,000	9
25,000	750,000	69,000	6.9
50,000	1,500,000	132,000	6.6
100,000	3,000,000	250,000	6.25
200,000	6,000,000	500,000	6.25

The cost of adequate elevated storage is thus from $2.50 to $3.60 per capita. Interest and depreciation at 6 per cent on this cost for municipal plants is but from 15 to 22 cents per capita per year, the equivalent of from 25 to 35 per cent of the average power cost where pumping is by electricity. Ability to avoid peak demand charges will frequently cover much of the fixed charges on the investment in elevated storage. The other benefits such as more uniform pressures, better operations of pumping equipment and safety against power outages, amply justify elevated storage in most water systems. The amount of elevated storage in each case is, of course, dictated by the individual conditions. The above is simply indicative of the possibilities to be developed.

Firefighting Considerations and Storage Costs

In addition to meeting all variations in domestic, commercial and industrial demands, a distribution system must be so designed as to transport the volume of water required for fighting fires. The rate at which water is required for fire service is a reflection of the character of development, whether suburban or metropolitan, fire hazards, and so forth. It varies approximately as the square root of the population in thousands and is, therefore, proportionately greater for smaller communities. The following table gives the amount of water required by the National Board of Fire Underwriters for fighting fires in cities of various sizes:

Population	Fire Demand (GPM)
5,000	2,250
25,000	4,750
50,000	6,500
100,000	9,000
200,000	12,000

The above quantities are required in addition to the ordinary uses at the time, usually considered as 150

per cent of the average for the 24 hours.

Fortunately, fires do not occur at frequent intervals but they do occur with sufficient frequency and intensity to demonstrate the wisdom of making adequate provision for them. The extinguishment of fires ordinarily uses less than one-half of 1 per cent of the total pumpage.

The fact that fires are relatively of short duration indicates the possibility of storage to provide the water required for fighting fires, thus avoiding sudden extreme drafts upon water production systems. The following table shows the fire demand rate, the volume of water required during 10 hours at the several rates (Underwriter's requirement), and the estimated cost of reinforced concrete reservoir construction to store the fire requirements for cities of various populations:

Population	10 Hour Fire Use (Gallons)	Cost of Reinforced Concrete Reservoir*	Ratio of Reservoir Cost to Distribution System Value
5,000	1,350,000	$ 55,000	27.5%
25,000	2,750,000	93,000	9.3%
50,000	3,900,000	113,000	5.65%
100,000	5,400,000	135,000	3.37%
200,000	7,200,000	158,000	1.97%

*To store fire requirement—such costs being based on E.N.R. Construction Cost Index = 250.

If the topography is such that reservoir storage equal to the fire use can be so located as to float on the distribution system, it will relieve the source of supply, pumping equipment and distribution system of the fire demand and thus affect the total valuation of $63 per capita. It is also available and useful for domestic peaks at all times without cost other than interest and depreciation on the investment.

If the reservoir is built at ground level comparable to the station, but at a point near the opposite end of the distribution system from the pumping station, it is of value to the source of supply and the mains but duplicate pumping equipment will be required. A reservoir of this kind benefits about 90 per cent of the plant valuation when used during fire, but is of less value during other periods as booster pumps must be operated to make its benefits available.

If the water required to fight fires is stored in a low service reservoir or clear well at the pumping station, its effect is limited to the source of supply; i.e., usually less than 25 per cent of the property valuation.

An elevated tank to store the quantity of water required for fire in a 5,000 town would cost about $115,000. Since such a figure represents about 60 per cent of the value of the entire distribution system, it is evident that the primary justification for the elevated tank in the smaller systems is in equalizing hourly variations in domestic use.

The ratio of the water required for fire protection, and for peak domestic uses, is shown as follows:

Population	Peak Domestic Rate @ 225% of 100 gpc/day	150% Domestic plus Fire	Ratio Fire to Domestic Peak
5,000	1,125,000	4,250,000	3.7
25,000	5,625,000	10,600,000	1.88
50,000	11,250,000	17,000,000	1.51
100,000	22,500,000	27,900,000	1.24
200,000	45,000,000	47,300,000	1.05

It will be noted that for a city of 5,000, the peak demand during fire, which is based upon the fire use plus 150 per cent of the average day domestic, is 3.7 times as great as the peak hour domestic use; decreasing progressively to 1.88 for 25,000 population, 1.51 for 50,000, 1.24 for 100,000, and 1.05 for 200,000. In other words, for a city of approximately 200,000 population or larger, the peak domestic use rather than the fire requirements determines the size of the distribution system. For all populations less than 200,000 the fire requirement is the governing factor in the design of the distribution system.

Sizes of Mains

A water works distribution system consists of feeder mains and lateral distributors to serve consumers. The proportion of the total flow during fire which is carried through the laterals may vary from a negligible amount where the lateral system consists of 4-in. mains or smaller to a material proportion where the lateral distributors are 6-in. or larger. In order to ascertain how the pipe sizes vary in the average distribution system, the pipe systems of eight cities varying in population from 5,000 to 300,000 were studied. In the average of these systems, approximately 55 per cent of the mileage of mains was 6-in. in diameter with 15 per cent 4-in., another 15 per cent 8-in., and about half of the remainder 12-in. The weighted average size obtained by multiplying the footage of each size by its diameter and dividing the sum of the totals by the lineal feet, is approximately 7-in. This weighted average diameter varied but little between the eight systems, the maximum variation being not more than 5 per cent either way.

A few cities such as Des Moines, Iowa, have in recent years adopted 8-in. as the minimum size to use, in which case the proportion and capacities of feeder mains is less and the weighted average size of the mains larger. However, in very few cities does the weighted average size of mains materially exceed 7-in.

Larger diameters of pipe provide more carrying capacity per dollar expended, as is shown by the following table:

Diam. of Pipe	Comparative Carrying Capacity*	Cost per foot Installed	Relation of cost to Capacity
4"	100	$1.10	1.1
6"	292	1.50	.52
8"	620	1.95	.31
12"	1,800	3.10	.17
16"	3,850	4.60	.12
20"	6,950	6.35	.09

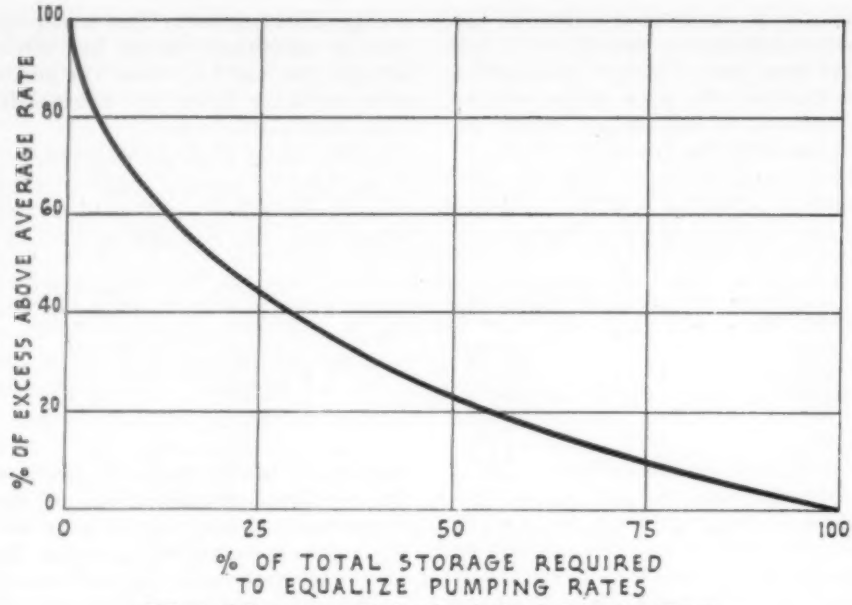
*Based upon C = 120 of Hazen-Williams formula and pressure drop of 8 ft. per 1,000 ft.

The above estimates of cost are based upon Class B pipe at $50 per ton and costs of laying, which were the average of those used in six recent midwestern appraisals.

From an analysis of the above, it is apparent that a 6-in. main costs about 36 per cent more than a 4-in., but with the same friction loss will deliver 192 per cent more water. Correspondingly, an 8-in., which costs 30 per cent more than 6-in., will deliver 112 per cent more water, and a 12-in., which costs 59 per cent more than an 8-in., will deliver 191 per cent more water. Expressed in another way, increasing the pipe diameter by one size increases the carrying capacity from three to four times as much as the proportionate increase in cost.

Effect of Elevated Storage on Expenditures for Feeder Main

As a general line of demarcation it may be assumed that, in the ordinary distribution system mains, 6-in. in diameter and smaller primarily serve the normal domestic requirements; and that mains 8-in. and larger, in addition to serving these requirements, have been so designed as to provide a circulatory or feeder system to carry the water from the pumping station or reservoirs to the smaller distributing mains. The beneficial effects of elevated storage



Effect of Storage on Reduction in Peak Pumping Rates

are, therefore, primarily limited to mains 8-in. and larger.

As stated, approximately 70 per cent of the footage of mains in the average distribution system is 61in. or less in diameter. However, the mains of larger diameter cost more per foot, and an analysis of a considerable number of distribution systems shows that approximately 45 per cent of the value of the distribution system is in mains 8-in. and larger.

The value of the mains over 8-in. in diameter in the average distribution system is approximately $15 per capita.

This value may be developed from the above figures on (1) the value of the average entire water works system at the present time, (2) the proportion of that value which is in the distribution system, (3) the proportion of the distribution system which is accounted for by mains, and (4) the percentage of total main value in mains larger than 8-in. In a city of 25,000 people the value of mains 8-in. and larger might be expected to be approximately $375,000.

Elevated storage sufficient to iron out the daily variations in flow in the average city of 25,000 population would cost approximately $69,000 at the present time, the equivalent of 18 per cent of the investment in feeder mains 8-in. and larger. If the topography is such that this peak requirement could be stored in a concrete reservoir at sufficient elevation, and not too distant, it would cost $36,000. This is less than 10% of the investment in feeder mains.

There is obviously no general rule that can be laid down as applicable to all cities. In a recent study for a city where topography is such that strategically located reservoir storage could be provided within the area served by the distribution system, the provision of storage sufficient to provide for both domestic peaks and fire requirements cost approximately 30 per cent of the investment in feeder mains, and less than the expenditures required without storage for the proper reinforcement of the feeder main system.

Loss in Carrying Capacity

Another factor which has had a large effect on distribution system design has been the necessity of anticipating a loss in carrying capacity with the passage of time. The extent of this loss was evaluated by Edgar K. Wilson (Jour. AWWA, Vol. 28, No. 9), who showed that, for midwestern waters in general, the Hazen-Williams coefficient decreased from 130 when new to 100 in about 20 years; a loss averaging more than one per cent per year. If such loss in carrying capacity were reflected in a comparable loss in valuation, this would be equivalent to a per capita loss of approximately $10 in a 20-year period, or 50 cents per capita per year, or nearly 10 per cent of the gross revenues of the average water utility.

Fortunately, this loss in carrying capacity is not correspondingly reflected in value. It is practicable to restore the carrying capacity to substantially its initial value by cleaning. Taking the average distribution system, the cost of such cleaning is approximately 5 per cent of the cost of the pipe installed new. Cleaning an entire system is seldom, if ever, resorted to. When main cleaning is done, it is usually confined to the feeder and circulating pipes where relation of cleaning to installation cost is even less than 5%.

Loss of capacity, however, is a serious indictment of the water works industry. Certainly some method of protecting so large a proportion of the total water works investment should be available at reasonable cost. It is rather surprising that the heavier cement linings have not been more largely adopted. The cost of heavy cement lining varies from 6½ cents per ft. for 6-in. pipe to 26 cents per ft. for 20-in. pipe, equivalent to approximately 5 per cent of the cost of the pipe installed. If its use will maintain the carrying capacity of pipe (as seems probable in most cases), its cost is well justified. Many designers have figured pipe sizes using Hazen-Williams coefficient of 100 instead of 130, in anticipation of loss in capacity. The cost of this excess capacity exceeds that of cement lining. Cement lining costs about the same as one cleaning but is better because it maintains capacity, whereas cleaning only periodically restores it. However, it is now possible to cement line mains in place after the cleaning operation.

Data regarding the maintenance of the coefficient of carrying capacity of cement-lined pipe are not so plentiful as for tar-coated pipe. The Cast Iron Pipe Research Association endeavored to secure such data by testing 42 cement-lined cast-iron pipe lines in 12 cities, located principally in the active or tuberculating water areas. All but eight of these mains had been in service from 10 to 16 years. The Hazen-Williams coefficient varied from 131 to 153, indicating little if any loss in coefficient value. Had these mains been tar-coated, it is believed the coefficient would have approximated 110.

The failure to adopt this improved coating more generally would appear to result from the average water works man's opinion that cast-iron mains, with the usual tar coatings, can be used in hard water areas without deterioration in carrying capacity. It is believed, by and large, that is not the case. It is suggested that, prior to the beginning of any important expansion of a distribution system, comprehensive flow tests be run and the relation between years of service and the Hazen-Williams coefficient be determined. If the loss is at all material, consideration of cement lining is suggested.

Unaccounted-for Water

There has been a greatly increased interest in "unaccounted for water" in recent years. As recent as 15 years ago, the average completely

metered, well administered water works accounted for less than 75 per cent of the water used. At the present time that percentage is about 85 per cent, with a very few cities exceeding 90 per cent. One city of approximately 150,000 people, which had been completely metered for 40 years, was accounting for but slightly more than 60 per cent of the water pumped. By careful attention to its meters, their repair and accuracy of registration at low flows particularly, the accounted for water in this system has now been brought up to 83 per cent. The utility is now being paid for 35 per cent more water than before the improved meter maintenance program was started. The principal change was to see that all meters would register the low flows.

It is believed that the most important factor in reducing the quantity of water unaccounted for is the careful maintenance and repair of meters, with particular emphasis placed upon the accuracy of registra- at *low* flows. Instead of referring to 15 to 25 per cent unaccounted for water, it has been suggested by Mr. A. P. Kuranz, Supt. of Water at Waukesha, Wis., that the unaccounted for water be visualized in terms of the equivalent waste of two to three months' coal, power and chemicals each year. In Mr. Kuranz's plant he has reduced the unaccounted for water to less than 7 per cent, an illustration of what can be done.

Water waste control, however, requires more than attention to the meters. It includes the necessity of locating leaks promptly and repairing them immediately. Every facility must be used to locate the hidden leaks, such as watching for melted spots on the streets during periods of light snow and listening at meters, valves and hydrants when routine inspections are being made.

Hydrants

Hydrants should be inspected at least twice each year, at which times they should be operated and checked for the operation of the drip, free draining, condition of packing, etc. They should also be carefully inspected after each use in the cold weather months. Each hydrant, too, should have a card on which should be recorded everything done to the hydrant, including each semi-annual inspection and what was observed at that time. Such a record is invaluable in case attempt is made to fix liability for a non-operative hydrant which may result from an attempt to open in the wrong direction, mishandling or some other cause.

It is good practice to install hydrants farther back from the curb and street corners than was formerly the practice before the use of the automobile became so universal. It is also good practice to have a shut-off gate valve on every hydrant connection.

Hydrants should never be operated by other than the fire department or water works employees. The occasional use of fire hydrants to fill sprinkling wagons, and to flush sewers and streets, is bad practice. It jeopardizes the ability of the water system to function when most needed. In one city, where hydrant wrenches were too freely distributed, the annual cost of maintenance and repair was over $8 per hydrant as compared to an average of less than $3. The number of hydrants replaced, in proportion to those in use, was double that of other cities where the use of hydrants was properly restricted.

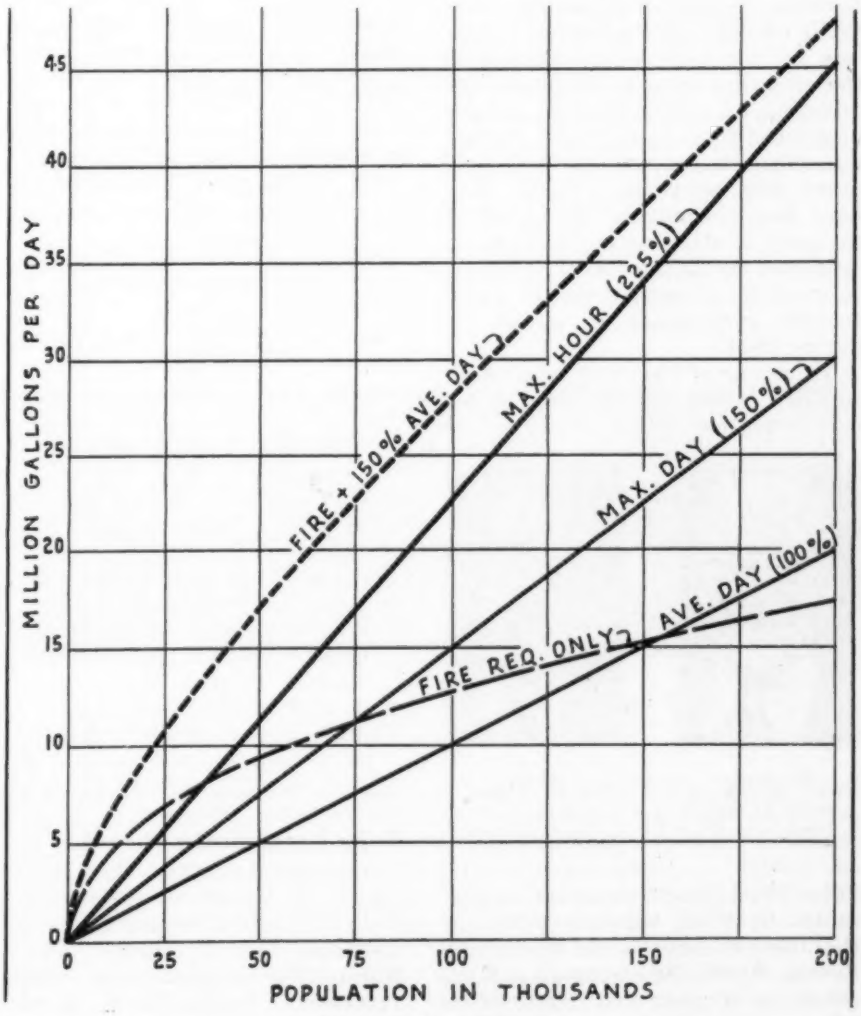
Valves

Valves should be inspected at regular intervals. If all valves do not open in the same direction, all exceptions should be recorded and their existence emphasized. Every valve should have a number and a card on which pertinent data relative to its location, installation, repair and maintenance are included. All valves should be provided with means of access, and it is good practice to install valves 12-in. and larger in vaults. Packing of valves should be inspected and adjusted when necessary.

Valves should be spaced at intervals of 500 to 800 ft. and so placed that no break will take more than two blocks of pipe out of service.

Distribution Maps

Too many water works either have no adequate map records or they are not kept up to date. A wall map should be available, of such scale as to make it usable. There should also be a sectional atlas of the entire pipe system on sheets about 24x36 in. and scale of 50 ft. or 100 ft. to the inch, with intersections and other congested areas enlarged when necessary.



Water Demand Rates
Domestic, Fire and Combined Fire and Domestic

MISSOURI VALLEY SECTION FEATURES POST-WAR PLANS

Informative Panel Discussion on Water Department Regulations Round Out Interesting Program in Des Moines

WHAT was generally conceded to be one of the most interesting programs ever staged by the Missouri Valley Section of AWWA, was that held October 15th and 16th in Des Moines, Ia., and representing the Section's 28th Annual Meeting.

It is regretted that this report of the interesting Missouri Valley Conference could not be printed in last month's issue. And, it is further regretted that the present squeeze in magazine paper is preventing us from devoting all of the pages deserved to the reporting of this interesting meeting.

[Concerning the paper situation this reporter along with a group of other technical magazine editors has just come from a conference with Director Donald Nelson and other WPB officials in Washington. Matters do not look encouraging until the situation becomes better in the direction of replacement of woodsmen taken from their timber cutting jobs for the armed services and other war activities. Some plans have been formulated in an effort to avert a still further restriction on paper use and we hope, thereby, to avoid the present threat of a still further curtailment in paper use during 1944.]

To us one of the most interesting sessions of the Des Moines Conference was that which featured the

Secretary
Earl Waterman
Univ. of Iowa
Iowa City, Ia.

Host
Dale Maffitt
Manager
Water Comm.
Des Moines, Ia.

"Blue Print Now!" program, as presented by Field Director Filby for the Joint Committee on Water and Sewage Works Development, and the outlining of plans and preparations for post-war water supply projects now being developed by several of the cities represented in the Missouri Valley Section. The other featured session was that devoted to the "Panel Discussion on Water Department Regulation", conducted by

Chairmen

Retiring	Incoming
Rhea Rees	*W. Victor Weir*
Superintendent	*Supt., St. Louis*
Sioux Falls, S. D.	*Co. Water Co.*

Melvin P. Hatcher, Director of Water for Kansas City.

Officers for 1943-'44

The following constitutes the slate of officers elected for the ensuing year and the new National Director elected for the three year service as the AWWA Board.

Chairman: W. Victor Weir, Sup't, St. Louis County Water Co., Univ. City, Mo.

Vice-Chm.: Kenneth J. Bunnell, Ass't Sup't, Metropolitan Utilities Commission, Omaha, Neb.

Sec'y-Treas.: Prof. Earle L. Waterman, Univ. of Iowa, Iowa City, Ia.

AWWA Director:* Dave Erickson, Sup't, Public Utilities, Lincoln, Neb.

Trustees:
Jasper Everett (Missouri),
Geo. A. Nelson (Iowa),
Paul D. Haney (Kansas)
T. A. Phillipi (Nebraska)
J. D. Davenport (S. Dakota).

*Mr. Erickson will take the seat of Director N. T. Veatch, Jr., on the AWWA Board at the close of the 1944 Annual Meeting of the Association.

Rupp Voted Fuller Award

During the Section's Annual Dinner, N. T. Veatch, Jr., reporting as Chairman of the Award Committee, presented Dan H. Rupp, Sup't of Water Purification and Sewage Treatment, Topeka, Kan., as their nominee for the Geo. W. Fuller Award for outstanding achievements in water purification plant operation and his contributions to the art of water treatment. Mr. Rupp, unable to attend the meeting, was voted the award for presentation at the 1944 Conference of AWWA.

Vice-President Newkirk Attends

Vice-President Sam L. Newkirk of Elizabeth, N. J., travelled to Des Moines to represent AWWA at the meeting. He made the principal address at the Annual Dinner, the theme of which was "What AWWA Can Mean to Waterworks Operators", and a summary of AWWA activities and its continued growth during these war years when ordinarily a net loss in members was normally to be expected. With 500 and better new members since Jan. 1, 1943, AWWA could boast a membership of only 73 short of 5000 at the time of his reporting. He cited the 100 member gain reported for the Southwest Section as an example of what can be accomplished with a "go-getting" Membership Committee in a Section.

Papers and Discussion

"The Need for Water Conservation in the War Effort", by Dale L. Maffitt, General Mgr., Des Moines Water Works.

In this presentation Mr. Maffitt, who is a member of the AWWA Task

National Directors

Elect	Incumbent
D. L. Erickson	*N. T. Veatch*
Director	*Cons. Engr.*
Public Properties	*Black & Veatch*
Lincoln, Neb.	*Kansas City, Mo.*

[*Director Erickson takes office succeeding Director Veatch at the close of the 1944 AWWA Annual Meeting.*]

Committee for Water Supply working with WPB, explained the efforts of WPB and the Fuel Administration to effect conservation in fuel and power. In this, 7 basic indus-

tries are cooperating through so-called Task Committees representing each. Citing the result to be attained by conservation, even a reduction of power consumption by 10% for the year would save 4,000,000 tons of coal. To reduce useless waste (or use) of water, Mr. Maffitt listed leakage and water waste surveys, controlled lawn sprinkling, more effective metering, reduced sewer flushing, and greater re-use of water by industries as the principal considerations. He referred to and exhibited AWWA's new booklet on Water Waste Prevention as a remarkable guide to the water manager who was genuinely interested in conservation of water and power.

In reply to a question Mr. Maffitt stated that on a thoroughly metered system not less than 85% of the input into the distribution system should be accounted for as the year's average. Month to month this figure would be higher or lower, with the highest at 90%.

Vic. Weir reported 86% accounted for on the St. Louis County system 100% metered, but covering a large County area. John Pray of Ft. Dodge said that by metering all water used by the city or others, 92% had been accounted for on his system.

A member objected to preaching water conservation in his community because the Water Department needed the money from all water that could be sold. Mr. Maffitt pointed out that it was not intended that any proper economic use of water should be curtailed in the conservation program. It was doubtful that a waste curtailment program would have any noticeable effect on the consumer billing.

"The Use of Small Sizes of C. I. Pipe", by Shirley W. Harris, McWane C. I. Pipe Co., Chicago.

Mr. Harris gave a brief but effective argument for the various uses of small diameter (1¼" to 3") cast iron pipes on the basis of adequacy and economy. Amongst such uses was to be found their use for tying in system dead ends, as duplicate lines, as a two main distribution system involving a 2" main on one side of the street and the larger main on the other side, and for service lines, extensions and for filter underdrains. Mr. Harris reviewed the improvements in small diameter cast-iron pipe within recent years. Amongst these were lengths increased to 9 ft. from 5 ft., improved joints (precaulked or screw) permitting jointing of long strings before lowering into the trench, better tapping bases. Mr. Harris emphasized the value of the two main systems and the surprising capacity of the 2" pipe which is now available with cement linings to maintain a smooth bore.

From AWWA Headquarters

Sam. Newkirk, Supt. of Water, Elizabeth, N. J. (Vice-Pres. AWWA)

E. L. Filby, Field Director "Blue Point Now!" Campaign

Post-war Planning for Water Works

This session was opened with a review by E. L. Filby, Field Director, Joint Committee on Water and Sewage Works Development, of the campaign of "Blue Print Now!", in order that the water works industry be not caught without ready-to-go plans and specifications for water supply betterments in the immediate post-war period. The following suggestions of orderly procedure were made by Mr. Filby: (1) Analyze the needs ahead; (2) Give the possible projects priority numbers for an orderly program; (3) Proceed to have actual plans and specifications drawn for the selected projects; (4) Reappraise the authority to raise funds, seeking in advance whatever legislation may be required to raise the funds; (5) Purchase lands and rights of way of earliest importance; (6) Above all else keep America American and tolerate no efforts in the direction of making our country socialistic.

Kansas City Plans were reviewed by Wm. T. Bailey, Chief Eng'r and Sup't, Kansas City Water Dept., who outlined the plans made for a 6 year betterment program in 1940 and only the softening and filtration facilities costing $900,000 had been completed on schedule in 1942, and the balance delayed by the war. The total programmed expenditure over the 6 year period ran to $4,318,000 of which $2,933,000 represented deferred expenditure for the post-war period.

At the present time a Hardy-Cross analysis of the K. C. distribution system is being made, the results of which will indicate probable further improvements needed in the distribution system, but not contemplated when the 6 year program was developed.

Mr. Bailey called attention to the fact that K. C. was now employing consulting engineers to make certain studies at a time when such firms were not so loaded with work. He felt that now was the time to get engineering services and avoid these organizations becoming skeletonized because of insufficient work to justify holding the organization intact.

1 *Fred Brune, Rensselaer, Chicago*

2 *L. Weatherford, Supt., Atchison, Kan.*

3 *H. F. Bloomquist, Supt., Cedar Rapids, Ia.*

4 *Jos. S. Nelson, Commissioner, Sioux Falls, S. D.*

5 *F. M. Dawson, Dean of Eng., Univ. of Iowa*

6 *Jos. W. Staub, Engr. of Water, Dubuque, Ia.*

7 *H. V. Pedersen, Supt., Marshalltown, Ia.*

Cedar Rapids Plans, as outlined by H. F. Blomquist, Sup't of Water, Cedar Rapids, Ia., includes much deferred maintenance, a series of feeder line extensions to be followed by plant extensions. The preliminary plans have already been worked out. In Mr. Blomquist's opinion, it will be wisdom for water works managers to be in readiness to proceed with actual construction immediately

that the war is won. To delay will, without much question, be at the cost of rapidly rising prices for both labor and materials, which is looked for as soon as industrial reconversion gets under way.

At Ft. Dodge, Ia., John W. Pray, Manager, Water Works and Sewerage, reported the purchasing of lands for water supply enlargement. Sewage works enlargement is also now in the plan stage.

The Marshalltown, Ia., Problem, as seen by H. V. Pedersen, Gen'l Mgr., Water Dep't, is going to be the financing of needed improvements in the nature of new mains and a 1 m.g. elevated tank amongst other things hoped for. To persuade the local political group that something should be done without waiting for a possible Government handout under the guise of unemployment relief was going to take a lot of effort. Therefore, without an educational program directed to the people, the water-works manager is to experience considerable difficulty selling the "Blue Print Now!" program of spending now for tomorrow's needs.

At Dubuque, Ia., J. J. Hail, Sup't, reported that plans are now being drawn for a softening plant and an elevated tank. Also a sewage treatment plant was being planned for Dubuque.

For the St. Louis County System, a privately owned system, Victor Weir, Sup't, stated that the problem of financing did not enter, as in municipal projects, and his company had definite plans for betterments. Vance C. Lischer, Eng'r in Charge of Production in the same company, told of continuing distribution studies and consumption factor study and routine maintenance programming involving a card index system which is infallible. [This system of routine maintenance perpetuation is to be described in an article being prepared by Messrs. Lischer and Hartung for an early issue of WATER WORKS AND SEWERAGE.]

In the general discussion which followed it was brought out (1) That, plans and specifications could be developed now without concern over radically new equipment, design, or processes to consider in the immediate post-war period. This much had been developed as the result of a questionnaire to manufacturers. (2) That, money was never cheaper than now and some far-sighted cities were arranging for long term loans now for post-war needs. (3) That, unless some very definite plans were made to put back water utility surplus funds into the system these funds might be taken by the city authorities for other post-war uses. (4) That, consulting engineers needed work at present and should be engaged now in order to prevent a disintegration of engineering organizations and loss of time, throughness and money occasioned by rush "peak loads" on engineering firms. (5) That, many systems really needed improvements before the war ends and because of Washington's recognition of the importance of keeping ahead on water supply materials would be made available, as the necessity indicates, before the war ends. (6) That, seemingly, water-works men had not been sufficiently participating in local governmental affairs and should be represented in local planning groups, or lose out in post-war improvement programs.

Panel Leader
M. P. Hatcher
Director of Water
Kansas City

Chm. Membership Comm.
Otto Reynolds
Leadite Co.
Kansas City

At the close of the session a resolution was offered and passed to the effect that members of the Mo. Valley Section encourage, support and push the "Blue Print Now!" program.

Water Dept. Practices and Regulations

This topic was handled as a panel discussion in which the following participated:

M. P. Hatcher,
Director of Water, Kansas City, Mo.
D. L. Erickson,
Director of Water, Lincoln, Neb.
John C. Detweiler,
Water Engineer, Omaha, Neb.
W. V. Weir,
Sup't, St. Louis County Water Co.

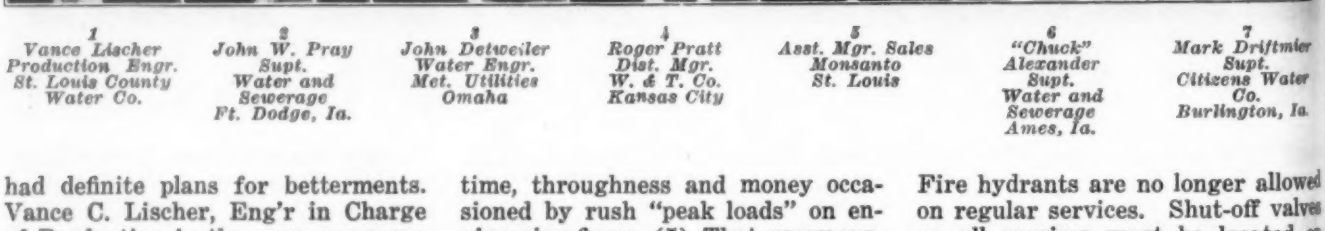
Following is a summarization of the questions and replies by members of the panel, as prepared by M. P. Hatcher who served as leader of the forum.

Fire Protection Services

Are fire protection services metered? Are fire hydrants permitted on regular metered commercial and industrial services? Do regulations permit regular services to be extended from fire protection services in a manner requiring the shut-off valve on the regular service to be located on the customer's premises?

Lincoln: Services used exclusively for fire protection are not metered. Fire hydrants are no longer allowed on regular services. Shut-off valves on all services must be located on public property and no regular services extended from fire protection services.

St. Louis County: Fire protection services are unmetered. A few cases of unauthorized use of water through sprinkler system services



1 Vance Lischer Production Engr. St. Louis County Water Co.

2 John W. Pray Supt. Water and Sewerage Ft. Dodge, Ia.

3 John Detweiler Water Engr. Met. Utilities Omaha

4 Roger Pratt Dist. Mgr. W. & T. Co. Kansas City

5 Asst. Mgr. Sales Monsanto St. Louis

6 "Chuck" Alexander Supt. Water and Sewerage Ames, Ia.

7 Mark Driftmier Supt. Citizens Water Co. Burlington, Ia.

have been encountered but a phone call to the inspector of the insurance company covering the risk always brings a stop to the practice. Customers having services large enough to support a fire hydrant will generally have separate fire protection services. Customers are permitted to place fire hydrants on metered lines although there is practically no demand for such services; they generally know that the insurance underwriters will give no credit for protection which is limited by the capacity of a compound meter. Moreover, the company zealously insists that the meter be sized for the regular use of water.

Extension of regular services from fire protection services is not permitted. Regulations require that the shut-off valve on each regular service and each fire protection service be located on public property.

Omaha: Only a part of the fire protection services are metered, including automatic sprinkler systems. Services to stand pipe connections or to sprinkler systems are metered where there is some chance that water might be used.

Fire hydrants may be installed on regular metered services of adequate size and the rates for such service is based on the number of hydrants. Hydrants on an unmetered fire protection service are sealed and the use of water from such hydrants is not permitted. If the service is completely metered, the customer may use the hydrant for purposes other than fire protection; however, this practice is discouraged.

Only in a few cases have regular water services been extended from fire protection services.

Kansas City: Regular fire protection services are not metered. A flat rate of $12 per year is made for each service regardless of the size. Fire hydrants on regular services are discouraged because of possible damage to meters from high flows; there are, however, a dozen or more such installations in the system.

As a rule customers are not permitted to extend regular services from fire protection services in a manner requiring the shut-off to be located on private property or in any way that would cause both services to be shut off by one valve. Two temporary war necessity exceptions were permitted for the duration only.

Programmers

Shirley Harris
McWane
C. I. Pipe Co.
Chicago

Wm. T. Bailey
Supt.
Water Dept.
Kansas City

Abandoned Services

Describe regulations with respect to abandoned services. How long do you allow them to stand idle before shutting them off at the main? Is property owner notified before abandoned services are disconnected?

Lincoln: Abandoned services are not disturbed except in the case of a leak in which case the service is shut off by the department without notice to the owner. The labor involved is charged against the vacant property and the charge is collected from the owner when water service to this lot is again requested.

St. Louis County: Abandoned services, such as those to houses which have burned down or have been demolished, are generally left for a period of two to five years. If in that time nothing has occurred to indicate a likelihood that the service will be used again and if the owner cannot be located for a statement of his intentions, the service is killed at the tap.

Where a service has been disconnected at the main without the owner's permission, the company bears the cost of reconnecting the service when its use is again desired.

Omaha: Unless an abandoned service develops a leak, that service is disconnected at the main only after a disconnection request has been made by the property owner. If an abandoned service develops a leak, an effort is made to locate the property owner in order that the owner may repair the leak; if the owner cannot be located, the service is disconnected at the main and every reasonable effort is made again to notify the owner of the action taken.

Kansas City: The owner is required to disconnect the service at the main when a building is burned, torn down or abandoned unless he will make a written statement that the service will be used within a year. The Water Department has been rather zealous in its efforts to have services disconnected as soon as possible after becoming unused because of the leakage threat. In many cases the work has been done by the Water Department and collection for this work cannot be enforced.

A relatively new kind of unused service has been encountered in recent years. Interconnections within adjacent business buildings have caused quite a few services to stand idle. This condition has caused service abandonment practice to be reconsidered. The present tendency is to be concerned with abandoned services only when they develop leaks, then to seek the owner to require the repair and failing in that to make the disconnection without cost to the owner.

Service Protection and Shut-offs

How are services constructed with respect to provision for shut-off and protection against freezing within the customer's premises? What type of stop and waste is required ahead of the meter? Is the customer required to maintain this stop-and-waste valve in serviceable condition?

1
Walter H. Metcalfe
Pittsbg. Des Moines Co.
Des Moines, Ia.
and
C. M. Dunlevy
Distribution Supt.
Ft. Dodge, Ia.

2
J. D. Senevy
Comm. of Collections
Kansas City
and
"Bill" Bailey
Supt.
Kansas City

3
Otto Reynolds
Leadite Co.
C. S. Timanus
Cons. Engr.
Kansas City
Vance Lischer
St. Louis Co.

4
Warren Kramer
Mo. Dept. of Health
Jefferson City
and
Roger Higgin
Supt. Filtr.
Hannibal, Mo.

5
Dean Dawson
Univ. Iowa
and
Dr. Max Levine
U. S. Med. Corps.
Fort Sam Houston
Tex.

Lincoln: A curb stop is installed near the curb line on each service. No protection against freezing within the owner's premises is required. The service is brought into the basement just above the floor line, a standard globe valve with manually operated waste is required just ahead of the meter and a standard globe valve is placed on the outlet side of the meter. The customer is required to maintain the stop-and-waste-valve in serviceable condition.

St. Louis County: The St. Louis County Plumbing Code (provided for by an enactment of the state legislature) requires a T-head stop cock in the street between the sidewalk and the curb and a stop and waste valve just inside the basement wall. Either a lever handle plug type or wheel operated compression type stop and waste valve is permitted although the latter has been used almost exclusively in recent years. The customer is required to maintain both the curb stop and basement stop and waste valve in serviceable condition.

Omaha: The service is provided with a curb stop near the curb line and a stop and waste valve inside the basement wall. The customer is urged to keep both of these valves in serviceable condition but this is not always done. Meter removal operations are inconvenienced somewhat by the failure of the customer to keep the basement stop and waste in proper condition; in these circumstances the customer is required to have the stop and waste repaired by a plumber.

Kansas City: Services are provided with the customary curb cock at the curb. They enter the house below the basement floor line and are provided with a plug-type stop-and-waste valve below the basement floor operated by a handle extended through a pipe set in the floor. This type of stop-and-waste valve has been found quite unsatisfactory. Roughly 30% to 40% become unserviceable before they are 10 years old. In normal times the customer has been required to maintain this valve in serviceable condition. More recently the shortage of plumbing help has caused a revision of this practice. The repair of such valves is not made a condition of continued service; now the customer is merely advised to repair the valve for his own protection.

1 "Bill" Birch (Himself) Chicago and "Bill" Hendry Supt. Waterloo, Ia. (Two Oldtimers)

2 Roger Crowell, Trustee H. P. Smith, Office Mgr. W. J. Lang, Manager Waterloo, Ia. and P. S. Price A. P. Smith Co. Chicago

3 Rhea Reese Supt. Sioux Falls Sam. Newkirk Supt. Elizabeth, N. J. Prof. Earl Waterman Univ. Iowa

4 Dave Erickson Director Properties Lincoln, Neb. and Ray Joslyn President Layne Western Co. Kansas City

5 Carl Brown Distr. Manager U. S. Pipe Co. Chicago and J. J. Hale Supt. Dubuque, Ia.

A Session—Not Scheduled

Nat'l Director, Tom Veatch; Neptune Meters, K. C. manager; Ira Collar (host), K. C. Director of Water; Melvin Hatcher and AWWA's Vice-Pres. Sam Newkirk are (left to right) the observers. A certain absentee K. C. resident (extreme left), after explaining in scheduled session the "Blue Print Now!" program, we understand took back to New York with him some of that good K. C. money brought up to Des Moines. Messrs. Senevy and Bailey (to his left) have opportunity to correct this report if in error.

Building Service

Under what conditions is service provided to houses or buildings under construction? What is the basis of the charge for service during the construction period?

Lincoln: For many years it has been the practice to provide permanent water services and meters in new buildings as soon as possible after construction work started. Because of damages to services and meters in the case of buildings built in the winter time, consideration is now being given to the plan of deferring meter installation until the building is ready for occupancy. In this case the property owner or builder will be billed at the minimum rate during the construction period.

St. Louis County: Service to houses under construction is rendered either on a flat rate or metered rate basis. Where sodding is required, it is mandatory that the sprinkling be done at metered rates.

For residence buildings the flat rate for the construction period is 0 cents per room for frame buildings or $1.00 per room for brick buildings. For commercial or indus-

1 Clyde Hum Pittsbg. Meter Co. Chicago and Walter Molis Supt. Muscatine, Ia.

2 H. H. Kamsteiner, Mgr. Leavenworth, Kan.

Roger Pratt, W. & T. Co. Kansas City

L. L. Weatherford, Supt. Atchison, Kan.

Ray Parker Hood, Chr. Kansas City

3 Post Conference Session (Into the Wee Small Hours)

4 Ray Parker Abner Hood Chem. Co. Kansas City

C. B. Pitcher Supt. Public Properties Ft. Dodge, Ia.

Harold T. Keefer Neptune Meter Co. St. Louis

5 Frank Lane Supt. Distribution Burlington, Ia. and Clyde Hum Pittsburgh Meter Co. Chicago

trial structures a metered rate is generally used although a flat rate is available based on the quantities of concrete, brick, plaster and other building materials required to construct the buildings. Most large scale builders prefer to be served at the meter rate since reasonable care in the use of water will reduce the cost of water service to approximately half of the cost of flat rates. Builders of individual dwellings more often prefer the flat rate basis despite its higher cost partly because they are generally not organized for good control of water usage and because the flat rate plan relieves them of the expense of providing suitable housing for a meter. The temporary flat rate is more satisfactory from the water company's point of view.

Omaha: Water service for the entire construction period bears the rate of $2.50 for residential houses of 6 rooms or less with an additional charge of 50 cents for each room for larger houses. Service during the construction period for commercial or industrial building is billed at rates based on the quantities of building materials used in constructing the building. No meter is placed in any building until the building is ready for occupancy.

Kansas City: The service is generally run as one of the first construction operations but the meter is not installed until the building is ready for occupancy. Water used during the construction period is sold to the builder at rates which are based on the quantities of building materials used. If the builder wishes to continue with unmetered service beyond the construction period, this service is rendered under a flat rate that has come to be known as a "sodding" permit because of its main purpose. This plan for collecting for this type of temporary service is burdensome and unsatisfactory for several reasons and consideration is being given to a charge based on the size of the house.

Temporary Service

What practice is followed with respect to temporary service of a kind that can be rendered from a fire hydrant? What is the basis of the charge for such service? Is the service metered? Do you permit the customer under such circumstances to operate the hydrant?

Lincoln: On payment of a permit fee of $10.00 per year the consumer (generally a contractor) is permitted to use water from any hydrant, provided the hydrant is operated with a standard hydrant wrench, and provided the flow from the hydrant nozzle is controlled by a manually operated valve on the service. The user is instructed to close the control valve before shutting off the hydrant, and is required to notify the Fire Dept. of his intention to use the hydrant.

The consumer is permitted to purchase water either at prescribed flat rates which are based on the quantities of building materials used in the project or at regular metered rates, in which case the consumer places a meter at the hydrant outlet. This meter is read by the department at frequent intervals, depending upon the size of the construction project.

St. Louis County: The use of fire hydrants as the source of a temporary water supply is allowed only in extraordinary cases. All fire hydrants are installed under rental contracts which provide for the use of hydrants for fire protection or fire drill purposes only.

On occasions customers obtain the approval of public officials to use fire hydrants for temporary water service subject to the final approval by the water company. A counter request that the public official absolve the water company from all liability should the hydrant be out of service in case of a fire has caused practically all such requests to be withdrawn or abandoned.

Omaha: To obtain temporary water service through a fire hydrant, the customer is required to pay a $5.00 license fee and post a $2500 bond indemnifying the city in case of injury or damage. In addition the customer is required to pay for the estimated quantity of water used, or for the water registered on a meter set alongside the hydrant. Under this plan the customer is provided with a hydrant key and is permitted to operate the hydrant.

To satisfy rather infrequent requests for the use of water for skating ponds in the winter or for truck gardens in the summer, a service has been provided which requires that the hydrant be operated by Water Department employees. The charge for this service is $2.50 per hour.

Kansas City: Practice with respect to temporary service from fire hydrants is only fairly consistent and uniform. Considerable attention has been given to the need for a definite workable plan without complete success. Present ordinance rates provide for a charge to contractors doing construction work that can be served from hydrants. This charge is based on the quantities of concrete, macadam, stone work and other building materials. Water Department rules which the Director is empowered to prescribe include one rule of long standing which provides that contractors may be furnished with a fire hydrant wrench for which they are required to make a $50 deposit. The contractor is required thereafter to report and pay for all water used. As would be expected, this practice led to utter lack of control of the use of water through hydrants. In recent years most of the wrenches issued under this rule have been reclaimed.

For the present, when water is to be used from a hydrant, an employee of the Water Department operates the hydrant. The customer pays a daily rate to cover the cost of such attendance plus the cost of the water either on an estimated or metered consumption basis. This plan has proven reasonably satisfactory.

Installation of Services

Are services installed by plumbers? If so, are plumbers bonded? What is the amount and scope of the bond? What is the scope of inspectional service applying to customer's services?

Lincoln: The regulations require that services be installed at the customer's expense by licensed plumbers operating under a $25,000 bond. The terms of the bond relieve the city of all liability for the work done or for neglect of any kind by the plumber while engaged on public property. In lieu of the bond the plumber is permitted to carry a public liability and property damage insurance policy endorsed to the City and the general public and providing protection against liability of the scope just defined.

All services up to and including the meter setting are inspected by the Water Department. All water piping beyond the meter is inspected by the City Plumbing Inspector.

St. Louis County: Services from the main to the customer's premises are installed by plumbers at the customer's expense. State law requires that all plumbers operating in St. Louis County be registered and bonded. The amount of the bond is fixed at $1000 and is for the benefit of the County or for injured persons or those whose property has been damaged by any violation of the provisions of the Plumbing Code.

The Plumbing Code authorized by state statute creates a Board of Plumbing Supervisors who appoint plumbing inspectors. The Company has no part in the inspection of service work done by plumbers.

Omaha: All water services are installed at the customer's expense by licensed plumbers who are bonded to the City in the amount of

$1000. The bond binds the plumber to proper performance of his work and protects the City against any liability for any injuries or damages growing out of his work on public property.

The Water Department inspectional service covers the materials used in the service, the depth of cover and proper installation up to and including the meter setting.

Kansas City: Services are installed by licensed plumbers at the customer's expense. The plumber is required to maintain a bond in the amount of $5000 which binds the plumber to compliance with Water Department rules and regulations, and protects the City against any loss or damage occasioned by the plumbers work on public property.

The water department inspection includes the service up to and including the meter setting.

Meter Ownership and Responsibility

Does the Water Department or plumber install meters? Does the customer or the Water Department own the meters? Does the customer or the Water Department pay for meter repairs? Do regulations insist on a check valve between meter and hot water heater to protect meter against damage by hot water? On what basis are meters removed from service for test and repair; periodically or when damaged or when there is evidence of improper registration?

Lincoln: All meters on new services are installed by licensed plumbers. All new meters on either new or old services are paid for by the property owners and remain their property. All meters are purchased from the Water Department; this plan assures Water Department control of the type of meter installed.

All meter repairs are made by the Water Department. The labor for meter repairs is furnished by the Water Department without cost to the consumer but the property owner is charged with the actual cost of the materials required for meter repair.

It has not been the practice to insist on check valves being installed between the meter and the hot water heater.

Meters smaller than 1″ in size are checked only where there is evidence of improper registration. All meters 1″ to 3″ in size are checked at least once every five years. Meters three inch and larger are checked annually.

St. Louis County: All meters are owned and installed by the Company. Ordinary wear and tear repair costs are borne by the Company but the customer is charged for repairs of damage resulting from customer neglect as in the case of damage from freezing or from hot water.

A check valve between the meter and a hot water heater is not insisted upon or even recommended. If the customer raises the point, he is cautioned that if a check valve is installed a pressure relief valve also must be provided for his protection. A fusible plug between the meter and the heater seems to provide a safer protection against damage to the meter by hot water.

The ⅝″ meters are removed periodically after 7 years of service or after having registered 100,000 cubic feet of water. Larger meters are removed at more frequent intervals; the period between removals from service for 6″ and 8″ meters for instance, is 2 years. The practice with respect to intervals or quantities metered between tests is such that accuracies on meters removed from service are generally acceptable.

Meters are seldom removed for test solely on the basis of a customer's contention that registration is in excess of actual consumption. In nearly all cases it will develop that consumption is high and that the meter is registering accurately. If the meter is replaced and consumption returns to the customer's conception of a normal bill as it generally will, the customer can seldom be persuaded that the original meter was accurate.

Omaha: Meters are installed by the Water Department. The customer provides the meter for service at a new location, but the meters below 1½″ in size are maintained thereafter by the Water Department except in the case of damage resulting from customer neglect such as that due to freezing or hot water. Maintenance and repair work on meters of 1½″ and larger in size is done by the department and charged to the customer.

Regulations do not require a check valve between the hot water heater and the meter.

Water meters are not removed periodically; they are removed only when there is evidence of damage either by freezing or by hot water or when there is other evidence of improper registration.

Kansas City: All meters are installed by the Water Department.

Until recently most water meters were owned by the customers. Prior to 1941 the City owned about 25,000 meters, acquired years ago, out of a total of about 85,000 meters. In 1941 the Water Department initiated a transfer-of-ownership plan which provided that the City would repair City-owned meters up to and including 1″ in size without cost to the customer and that it would replace City-owned meters when they could no longer be repaired. The plan included the offer of the City to accept ownership to any customer-owned meter.

Regulations do not require a check valve in the supply line to heaters. When the subject is raised by the customer as it is occasionally, the idea is discouraged.

Effort is made to check meters 3″ and larger about once a year. Smaller meters are removed for test and repair only when there is evidence of improper registration. As far as permissible small meters that have not been off the line for 5 years or more are removed for test.

Dean Dawson, Univ. of Iowa, pointed out the hazards of check valves on the supply line to the house boiler and also that for any real protection there must be both a temperature and pressure relief, and there was no adequate temperature relief unit available.

This brought up the subject of check-valves as a means of preventing back flow through cross connections or interconnections of syatems. Dean Dawson commented most favorably on two new check valve arrangements put out by two California firms. Tests of these units in the Hydraulic Laboratories at Univ. of Wisconsin had confirmed the claims as to their reliability in comparison with older type valves.

The discussion then turned again to meter damage by hot water and it was stated by Mr. Weir of St. Louis County that this appeared to be a diminishing problem. Only about 1% of the meters in service are damaged by hot water back-up. Damage from hot water could be detected by leaking gaskets as slow down as stoppage of the meter.

Firemen Read Meters

In discussing the present meter reading problems it was stated that women meter readers get around only about half as rapidly as the men readers. A unique solution to the problem in one instance had been the employment of Fire Dep't employees on their off days to read meters at five cents per meter. This scheme has worked very well and to the advantage of all concerned. The Fire Chief liked the idea because it gave the Department a picture of basement conditions over the town.

OFFICE RECORDS IN WATER UTILITIES*

By FRED J. RENY, Gen. Mgr.
PORTLAND WATER DISTRICT
PORTLAND, MAINE

NO PERSON unfamiliar with utility work can realize the number of records which must be made each day in a utility office. Small utilities do not have the number or volume of records that bigger ones do, but there are some records which are identical, and must be made by all utilities, large and small.

The physical work of making records must be divided into several groups in the large utilities. There must be records in various departments, such as office department records of many kinds, including telephone and personal requests, cash and credits, services off and on, meter records, gate records, and many others. From the other departments come records of the pumping station, including coal, gasoline, oil, electricity, and pumpage of water.

From the engineering department come the records of surveys for work under consideration, of location data of service boxes, of maps and plans of the utility. From the chemist are received the purification charts and graphs, showing the operation of the filtration or purification system. From the construction and service department come the numerous records of shop payroll, and all the information which has to do with workman crews, including transmission and distribution records, service records, meter and garage records and many others.

Customer Change Records

Perhaps there are more changes in customers than anything else at the present time. These changes consist of sale of property, change of tenant, new services, and changes from one classification to another. During the last year, we have averaged one thousand changes in the stencil list each quarter. This is about three times the usual number caused by real estate activity; this means a great deal of additional stencil work.

Every notification of sale of property means a change record for the addressograph. The meter must be read, and a contract signed, by the new water taker; careful study of the ledger account must be made to see whether a deposit should be required to guarantee water rates.

The Author

The changes which must be made in this simple, everyday transaction include a change card for the addressograph, a contract card for the new customer, a transfer of the new customer's name on a street index, a new ledger card, a reading of the meter to bill the former taker, a bill to former water taker, and perhaps a refund of consumer's deposit.

Many years ago there were but two important records made as follows: The turn-on record was made in a white book, and the stub and let-on order both carried the same number, exactly like a check book. When the water had been duly let on, the clerk signed his name and the date of the let-on and posted the date in the ledger so that billing could be made. After the posting, the order was pasted back in the let-on book and this was the permanent record.

The shut-off record was made exactly the same way, except that the shut-off was made on a book which had yellow pages. When each book was exhausted, a new one was started with the numbering extended.

Off and on records were very important in the water office and had a great deal to do with the billing. As soon as the water was let on the billing started, and when the water was shut off, the billing stopped. The life blood of the water department in those days was not all water service, but money, so the billing and collecting were very important; in fact, more important than the effort to give service to the water taker.

As the number of water takers increased, it soon became necessary to abandon the big books used as a customer's ledger, and the card ledger with the individual ledger accounts with each water taker was adopted.

Prior to this time no thought had ever been given to the idea of writing the orders with a carbon and retaining a duplicate for filing, but the Egry Register now used is a simple printed form and carbon duplication is so easy that one clerk can easily post the off and on records and file them in a 3 in. by 5 in. steel cabinet drawer.

Card System

These cards were stenciled with the addressograph in order to print the water taker's account number, name, and address. The cards were printed to carry eight years of record with the customer. Each card was classified as per the orders of the Public Utilities Commission; that is, residential, flat and metered; commercial, flat and metered; industrial, flat and metered; private and public fire protection, and governmental accounts.

In order to segregate these classifications, it was decided to adopt several colors to designate them. Thus, the residential flats are all on white cards and billed on white bills. The commercial flats and commercial meters are on green cards and are billed on green paper. The residential meters are all on buff cards and the industrials are on salmon cards with a bill of the same color. Governmental, commercial and industrial are all metered and bills are the same color as the ledger cards. Private and public fire protection are recorded on white cards.

There may be many other and easier ways to keep a ledger account with the water taker than the ledger card, but we have not had to apologize to any of our customers because of a lack of record of any kind pertaining to debits or credits, or off and on records, which are on the same line opposite the debits and credits. Meter records are also recorded on the ledger card together with the readings and consumption.

The customer's bill and ledger debit are made by one impression on the billing machine. Thus, there is no question that the bill and ledger must be identical and the total of the bills is the exact total on the ledger cards. We are now billing quarterly 25,000 water takers—nearly 50 per cent metered.

*Presented at the Annual Meeting of the Maine Water Utilities Association at Bangor, Me., Oct. 13, 1943.

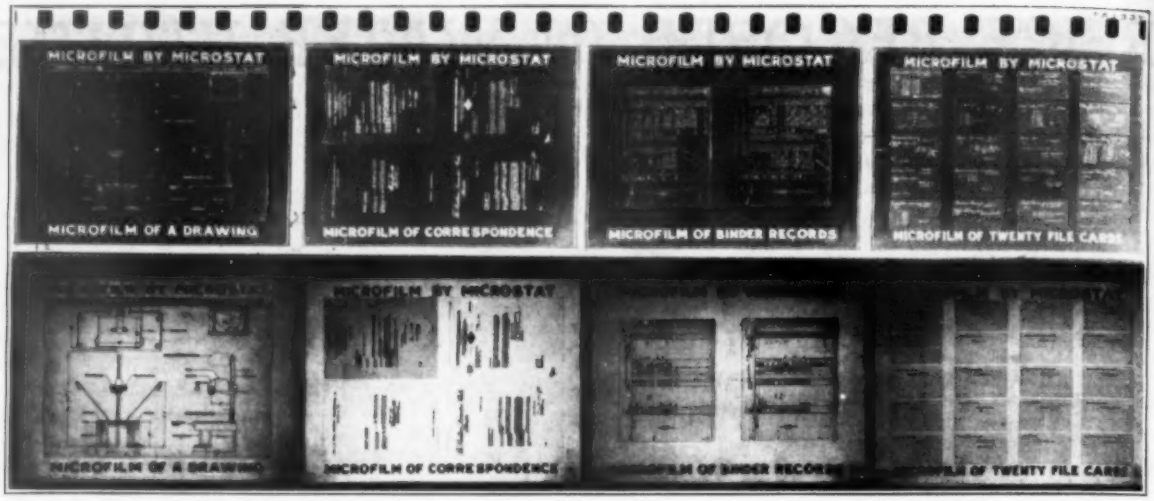


Fig. 1—Exact Size—Microfilm 35 mm. Negative and Positive Transparent Print (From the negative enlarged photographic reproductions are made in original size.—From the positive a projected image may be read on a ground glass screen.)

When the customer presents his bill for payment, the bill is stamped by insertion in the cash register. The exact amount paid on each bill is recorded on the bill and the stub. The stub is detached automatically and dropped into a box under the counter. The paid stub is then used to credit the customer's account. In case the bill is paid by check and only the stubs are mailed, then the stubs alone are run through the cash register.

Cash and Complaint Record

Consider other records in the water department. How about cash? Is a complete cash statement made every morning? May an audit be made any day of the month?

To the previous day's back balance is added the bank deposit. This deposit is the exact amount of the day's receipts. From this total is subtracted all disbursements of the previous day. The totals in all banks must agree with the totals in the general office ledger; also, all cash in the petty cash box in the office must be accounted for each day. A duplicate of all bank deposit slips is attached to the day's statement.

About complaints? Is a record of each one and a check to see if the same one is recurring? It has been our practice for several years to buy a diary each year and for each day enter any complaint of consequence and how it is disposed of. This has been a very valuable and useful record to refer to in a great many instances.

Daily records must also be received from the men who are on duty at night. Janitors are required to report all visitors to the office building, who they are, the nature of their business, when they arrive, and when they leave. Night reports are also received from the service department so that all work or complaints during the night can be sorted over the next day and filed in their respective places. In all of these records standard sizes of cards are used as far as possible; that is, 3x5-in. cards, 4x6-in. cards and 8½x11-in. records. This makes easy filing in standard steel cases. The standard size is something that should be adhered to.

Another record of great value is the scrap book which every utility should keep. One clerk should be detailed to clip every single newspaper item referring to the water department, and to properly paste it in the book. This record over a great many years will be very valuable for reference.

Fig. 2. Microstat High-Precision Microfilm Reader

Record Filing and Storing

The question of office records, leads to the all important question as to how these records are to be filed away for safe keeping and how long they should be kept. Should there be a statute of limitations on office records? Naturally, all records pertaining to the investment of capital accounts or the building up of valuation should be maintained forever in order that proof may be given of the proper investment in the plant of the utility. Also, all disbursements and vouchers must be always permanently retained, and care must be taken that these important records will never be lost.

The perpetuation of utilities records has been considered by the Maine Public Utilities Commission. In the Uniform System of Accounts issued in 1936 for water utilities, we find on page 12 the following: "Except as hereafter authorized by the Commission, all operating, accounting, or financial papers, records, books, memoranda, invoices, stubs, maps, or documents, or any papers or records which support entries to any of the accounts, or which are necessary for an analysis of accounts, or which may be useful in developing the history of transactions, *shall be retained permanently.*"

We do not know how literally this must be taken. If it is meant to be literal and every single thing mentioned in the above order has to be retained permanently, it is most certain that utilities will require large storage space to store all such rec-

ords. This has caused the Portland Water District to be somewhat embarrassed by the amount of storage space required even up to the present time, after nearly thirty-six years of operation. We have planned a large brick vault in the basement of our building where a great deal of this record can be stored. However, it is not strictly fireproof, and in case of a conflagration in the city, most certainly valuable records would be destroyed.

We had previously been approached by insurance companies desiring to insure our accounts receivable. However, this did not appeal to us as the cost was high, and in case of damage or loss of records all that the insurance company could furnish would be a payment of a sum of money, which would not, of course, replace the record itself. It was also necessary to render to the insurance company a statement of balance each three months, which, of course, would be more office work.

Microstating

Recently the Microstat Corporation of New England, approached the Portland Water District with a proposal to microstat some of its records and to put them in some safe, where in case of loss by fire, that the records which had been microstated could be replaced without further cost in their original size. This seemed to be something that was extremely valuable as indicated by the adoption, by the U. S. Government, of microstating as the method of reproducing maps and plans of Lend-Lease material which might be lost.

We believe we are pioneers in the microstating the office records of a water utility and that microstating will be something every utility will consider for future protection if not for the present. Certainly, the ability to reproduce all of the customers ledgers showing all the different accounts, street numbers, names, register numbers, route numbers, and classifications perfectly reproduced in case of loss would mean a great saving to any utility and a peace of mind in case of war or any other kind of a catastrophe which might destroy the records of the utility.

Examples of the type of records microfilmed are shown in Fig. 1. The negative (white lines) is the strip from which records are reproduced. The positive film (black lines on white) is used for reading the record on a glass plate as shown in Fig. 2.

In addition to the ledger record we have also microstated the maps and plans of the distribution system and transmission system of the District. The entire cost for more than 28,000 impressions has been slightly over $1,100. We do not feel that the expenditure is a large one for the tremendous advantage that this gives us in case of any loss which might occur, and we can only believe that we have exercised a considerable amount of foresight in protecting our records, and by so doing it is possible that we may save a great amount of space when the question of how many and what kind of old records may be done away with safely.

PERPETUATION OF ESSENTIAL RECORDS BY MICROFILMING*

By CHARLES A. JORTBERG, Jr.
MICROSTAT CORP. OF NEW ENGLAND
PORTLAND, MAINE

THE rapidly changing developments of the past five years with its daily record of appalling catastrophies both from the ravages of modern total war and from the almost equally severe series of domestic casualties have combined to raise the question as to the adequacy of past and present practices as regards record storage in the minds of many administrative executives of vital public utility services.

The very frequency and extreme severity of these daily illustrations has bewildered all of us in our attempts to keep abreast of the current changes in values as they apply to what we have always accepted as sound practices.

It would seem timely then to examine these changes in values as to how they can affect the vital services provided to the public by water utilities. Such an examination is bound to focus attention on the fact that the very foundation of the services so ably rendered is made up of the records of experience, records of successful ideas and methods, of equipment, design and operation. If entire plant were to be destroyed overnight, it could still be replaced, *provided you had the records from which to work*, BUT if the records, too, were destroyed with the plant, there is small likelihood they could be replaced.

The Author

Replacing Records

Utilities are definitely faced with an unusual financial problem in this matter of destroyed records. Should this happen, the administrative heads of the utility are faced with the problem of replacing these records or liquidating its services; there are no other alternatives. Replacement is a real item of cost and one which must be absorbed by the going business, and therefore be a very definite contingent liability. Sound management and conservative accounting practices call for setting up reserves for such contingent liabilities for the protection of the capital structure of any going business or utility.

The measure of this liability is indeed a most difficult task under ordinary methods. One of the larger utilities in Maine sustained a severe total loss of vital records over forty years ago. The long and tedious replacement of those records by hand rebuilding has cost approximately $50,000. Even after forty years only 90 per cent replacement has been effected. Replacement by original methods is a most expensive and unsatisfactory process.

In this matter of vital water utility records the only way in which this liability for cost of replacement

*Presented before the Maine Water Utilities Association at Bangor, Me., Oct. 13, 1943.

can be eliminated entirely and at the same time its cost be predetermined in a specific manner, is by preserving and perpetuating those records in a manner that guarantees that they can always be available in their original form at short notice.

The only way this can be done is by keeping full exact and precise duplicates of all these vital records on other premises in locations that definitely are not subject to the same hazards under even the worst of catastrophe conditions.

In your consideration of the duplication of the vital water utility records that are your responsibility, two measures should be applied to any method that presents itself: First, will the method give you precise, exact and facsimile copies of the originals you wish to perpetuate and preserve? Second, will the method stand the test of permanency?

Precision Microfilming

A number of phases of scientific knowledge have been combined to produce the modern miracle in the process of precise duplication known as "*Precision Microfilming.*" By definition, precision microfilming is the compressed precise recording of vital records on strips of high contrast, high resolution safety film.

As a method of duplication, precision microfilming meets the requirements of accuracy and permanency completely; it is most economical as to cost; it provides a degree of compression of space that saves 99 per cent of the usual space required for storage of records.

Microfilming, like other business processes, is subject to application effectively and economically only when performed with proper equipment, operated by adequately trained personnel and using only the type of film that meets the requirements of high precision and long life. Under these conditions it will successfully record and preserve the most intricate of documents, plans, drawings and records.

The Equipment

The microfilming equipment shown in Fig. 1 is the only combination of its kind ever built—an all-purpose camera, projector and enlarger. The equipment weighs about half a ton and costs several thousands of dollars to build. This completely motor-controlled (Microstat J-7 camera) will separate nearly 3,000 lines to the inch, or more than ten times finer than the finest screen halftone in commercial use. Electric motors calibrate the focus to .00025 inch, which is equivalent to splitting a .005 inch thin piece of film into twenty thinner strips.

When properly operated by technicians specially trained for the work, the equipment will provide on one little section of microfilm an optically perfect image of a 28½x 37 15/16 inch tracing, or four legal contracts, or 8½x11 inch letters, 20 file cards, or a very large map. To all practical purposes these maps, particularly the large one, are about 1,000 to 1 shots. About 1,000 square inches of copy are reduced on Microfilm by Microstat to less than one and one-half inches of imperishable negative. On these reproductions every line and dot is as perfect as it was on the original. Because of this photographic compression and subsequent possible reproduction, the microfilms of 300,000 square feet of originals can be stored for absolute safety in a small deposit box in a bank.

As for permanency, the microfilm is imperishable safety film, the base of which is non-explosive and fire-resistant cellulose acetate. The National Bureau of Standards of Washington, D. C., states that this film will last as long as good all rag content paper, which is probably 500 years. Thus records recorded on this film, processed, stored and used according to Microstat methods and standards should be legible for reproduction in 2443 A. D.

Microfilm Insurance

The practical application of precision microfilming to meet the needs and demands of modern business by the compression of vital records for purposes of perpetuating these records requires much more than just the equipment and the op-

Fig. 1—The Microstat Camera Equipment

erators for the equipment. Microfilming as a method of duplication does have the faculties of extreme accuracy and also real permanency, but the vital question of the contingent liability in the cost of replacement of vital records after they have been destroyed is not solved by mere microfilming. True, precision microfilms will make facsimile copies of the originals of vital records available, but the process of reproduction will be costly when records become destroyed and their facsimiles are reproduced from microfilms.

The real answer to the problem of replacement cost was recognized early in the development of *precision microfilm service*. By means of insurance that not only insures the microfilms themselves against loss or damage from "any cause whatever," but also provides a contingent coverage for original records in the event they become damaged and loss occurs from "any cause whatever." This contingent coverage is an amount equal to ten times the cost of making the microfilms and will specifically pay for the cost of reproduction of the original records from the microfilms when the originals become a total loss.

In other words, microfilming records on this Precision Microfilm Service basis requires but one overall cost of very few cents for each exposure on the film. The purchaser receives not only the films on which the records have been recorded, but also a certificate of insurance from one of the recognized leading marine insurance companies of this country which indemnifies the purchaser against both the expense of duplicating the microfilms if the necessity should arise and the much greater expense of reproducing facsimile copies of the originals once they have been destroyed or lost. Thus, when a utility records its vital informative records it has not only provided completely accurate facsimile information for the future, but it has also eliminated the bugaboo of the contingent liability it has heretofore faced in the probable replacement cost of destroyed records.

How the Work Is Done

When a utility wants its records preserved by this most practical method of duplication, the following procedure takes place. In order not to interfere with the regular routine of the daily transactions of the utility and to prevent misplacement and consequent delays and losses from improper handling of the records of the utility, the equipment is shipped right into the office or plant where the vital records to be filmed are kept. Trained operators are sent with the equipment to install and operate it. The utility's own employees bring the material to the equipment and then replace in their own files after it has been microstated. The negatives on the films are then sent to a special laboratory for processing and inspection, as shown in Fig. 2. When the processed film is returned to the utility for safekeeping it will only contain exposures that are absolutely accurate and 100 per cent usable, with no duplications, errors or poor exposures. Such a guarantee can only be met by a strict method of inspection in the processing; this inspection entails fifteen individual steps for the protection of the utility whose records are being microfilmed.

When the processing and inspection are complete, the negative microfilm is then delivered to the utility in rolls containing about 750 exposures per roll. With the rolls of film is also delivered an index of the material on the rolls so that they can be used for reference if necessary; these rolls are carefully packaged and labeled on delivery. The cans containing these rolls of negatives are then stored in a bank safe deposit box in a city other than where the original records are kept. These negatives are the permanent file of the vital records of this utility and should never be used until the need for reproduction arises, such as the destruction of the originals from any cause whatever.

Fig. 2—Processing and Inspecting Microfilm

Positive Prints

It is possible to even eliminate old records by the Microfilm Service and yet have the record available for ready reference. This anomalous

miracle is done by positive prints of the microfilm negatives.

At Portland, Me., where the utility was cramped for space and found the addition of more storage space almost impossible under present conditions, positive prints of the film were made, specially indexed, and filed in 12-in., eight exposure strips in labeled boxes, designed to fit ordinary letter files.

In order that the records on these strips may be ready for frequent reference in its original form, a machine for reading the material on these positive strips is also placed in the office of this utility. On this machine the strip of film is held flatly by the piece of glass, and then inserted in the machine, and on the screen is found projected the material from the strip enlarged to its original form, easily readable with no eye fatigue or strain.

By this means, a whole floor full of records can be filed in the small space of a four drawer letter file—more accurately and permanently. The old records that have been so costly can then be destroyed and the space given over for more productive purposes. When the old records are destroyed for purposes of conservation of money and space, the utility on receipt of the positive film for reference purposes, this film is also protected in the event of loss or damage by the certificate of insurance which provides for paying for the cost of replacement of the positive strips in event of their destruction or loss from any cause whatsoever.

That such a service is completely accepted as a usual business practice is evidenced by the fact that the U. S. Internal Revenue Dept. has ruled that microfilming of business records is an ordinary and necessary expense of business and as such is deductible in computing earnings for income tax purposes.

The value of microfilming as a method of duplicating vital records has been recognized by the Legislature of the State of Maine; it provided the authority for County Commissioners, the State Controller to use this process, and provides such microfilms shall be acceptable in court as evidence.

Many of the Federal Governmental agencies have definitely ruled that microfilms when made on the precision basis, are acceptable in lieu of original records when such records are required to be retained for any period of time—the Federal Power Commission, Labor Department, War Production Board manufacturers of war supplies and other governments.

To administrative executives of water utilities there is much to commend the service of PRECISION MICROFILMING SERVICE as indicated by a summary of its advantages:

1. It is the only known method of duplication which will eliminate the contingent liability of replacement cost of vital records.
2. It gives complete protection in the event of disaster and will contribute much toward maintaining the chief objective of any water utility—the providing of a constant steady flow of water.
3. It insures the cost of replacement.
4. It conserves space and filing expense.
5. It provides for permanency of all your records.
6. It is the most accurate method of duplication known.
7. It does not require records to leave your own premises.
8. It has no limitations as to size or intricacy of material to be preserved.
9. The act of microfilming in this method binds your records permanently in their proper sequence.
10. It is sufficiently inexpensive to be within the budget requirements of even the smallest utility.

METER READING PROBLEM SOLVED

City Firemen Employed as Readers on Their Off Days

H. S. Merz

By H. S. Merz
Supt. of Water
ROCKFORD, ILL.

THE Water Department of Rockford Ill., has been troubled with shortage of personnel for meter reading for the past year. Young men who were on the force reading meters were caught in the draft, others were hired and they likewise were either drafted or quit to take jobs considered more essential to the war effort. During this past summer, in desperation, as an experiment an attempt was made to hire high school girl graduates. These were not available, but two juniors were, and these girls were hired to read meters and did very well. However, this expedient did not completely solve the problem because these girls had to leave to return to school. Then the department worried along for about three weeks with some of our regular men working at reading meters on their off-days and on overtime. This procedure did not work because there was more work to do than could be done by them. Then the thought came to us that we might possibly secure the aid of some of the city firemen, and an appeal was made to the Fire Department in this direction. Arrangements were made and the scheme has worked out most satisfactorily.

At this writing there are three men working as meter readers for the Water Department on their off-days from duty in the Fire Department. The job is set up on a piece work basis, 5c for each *good* reading and 2½c for each post card returned by the customer properly filled out. Earnings average from $6 to $9 per work day.

About 60 per cent of the post cards left at the customers' premises are returned properly filled out. The latter practice has been in vogue, however, since 1938, and has saved thousands of man-hours required for making pick-up readings. All meters which have not been read for six months (two readings) are routed in with other service work for pick-up readings. All high readings are checked for leaks by the inspectors, and if leaks are found, customers are so notified and ordered to have them fixed.

Our hats are off to the three firemen (Donald Hogan, Albert Sapariti and Henry Mulder) who are helping us keep the Meter Reading and Billing Department going.

A sidelight of interest in connection with this scheme is the opportunity which the Fire Department now has of spotting fire hazards which prevail in so many basements. It is evident then that both the Water Department and the Fire Department have gained something through the arrangement. We, therefore, pass along the idea to others for what it may be worth. For us at Rockford it has proved the solution of a very perplexing problem.

SOUTHWEST SECTION'S SECOND WARTIME CONFERENCE

Highlight Is 100-Member Gain for Year Reported at Oklahoma City Meeting

A Report by
EDW. R. STAPLEY
Acting Dean of Engineering
OKLAHOMA A. & M. COLLEGE
STILLWATER, OKLA.

THE Southwest Section of the American Water Works Association closed its Second Wartime Conference (32nd Annual Convention) at Oklahoma City on October 13. The attendance at the three-day meeting was even greater than at its first highly successful Wartime Conference of the previous year. Headquarters for the meeting and manufacturers' displays was at the Oklahoma Biltmore hotel.

Chairmen

Retiring	Incoming
*L. A. Jackson**	*R. W. Harding*
General Manager	*President*
Water Dep't.	*County Water Co.*
Little Rock, Ark.	*San Antonio, Tex*

**Also honored with the Fuller Award for outstanding service to the profession at large and the S. W. Section in particular.*

Robert W. Harding, president of the Bexar Water Department of San Antonio, Texas, was elected chairman for the coming year. Other officers chosen were A. H. Ullrich, chemical engineer at Fort Smith, Ark., Vice-Chairman; Ed Byerley, manager West Helena, Ark., water department, Arkansas trustee; C. A. Beutall, Waterworks vice-president, Metaivi, La., Louisiana trustee; Edward R. Stapley, acting dean of engineering at Oklahoma A. and M. College, Oklahoma trustee; and A. S. Hatch, superintendent water division of public utilities, Houston, Texas, Texas trustee. George J. Rohan, water superintendent, Waco, Texas, was reelected to the position of Secretary-Treasurer.

"B. G. Cole, Water Plant Chemist at Monroe, La., was selected as a new member of the Publications Committee for the Southwest Water Works Journal, to serve with Egmont S. Smith, Chairman; M. B. Cunningham, member; and George H. Rohan, Ex-Officio member."

Through the efforts of its officers and members the membership in the Southwest Section was increased during the past year from 163 to 263 active members. These 100 new members proved an important part of the 486 new A.W.W.A. members since Jan. 1, 1943, as reported during the conference by Samuel F. Newkirk, Jr., A.W.W.A. vice-president.

Fuller Award to Jackson

Selected as the recipient from the Southwest Section of the 1943 George W. Fuller Memorial Award for distinguished service in the waterworks field was L. A. Jackson, manager of the Municipal Water Department at Little Rock, Ark., and retiring Chairman of the Section. In addition to his many other contributions to the water works profession, the retiring chairman was cited as being personally responsible for a large part in the year's outstanding membership increase of the section.

At the "Get Acquainted Luncheon" of the opening day, Captain Max M. Fife, U. S. Marine Corps and president of the Section in 1929 and 1930, presided. Association and conference officials and a few special guests were introduced.

Late cancellation by the government of bus transportation arranged for the barbecue luncheon and inspection trip to the Bluff Creek Reservoir project caused hasty changes in the program. Through the courtesy of its officials the luncheon was served at the Sherman Machine and Iron Works in the city. Opportunity for the visitors to inspect the Bluff Creek project was provided by scheduling trips in private cars at convenient times during the meeting.

The final luncheon, a "Get Together Water Works Affair", was held Wednesday noon. President L. A. Jackson introduced the Section officers and water works "old timers" W. P. Birch, Egmont S. Smith, Arthur C. Clark and Charles Barry. The latter attended the first meeting of the Southwest Section at Temple, Texas, in 1912, and has missed only one annual meeting since that time. Vice-president Samuel F. Newkirk, Jr., of the A.W.W.A., talked briefly on the subject of the "A.W.W.A. in War Time." He spoke of the streamlining of the annual meetings and the activity—but on a somewhat reduced tempo—of the various committees and subcommittees. The Committee on Specifications was particularly commended for its work in revising specifications to keep up with the forced use of many new and substitute materials due to the war. Growth of membership in the A.W.W.A. was stated to have been as great in the last 10 years as in its entire existence prior thereto. Credit was given the Southwest Section for the major role it had played in increasing the membership in the Association during the year just closed.

The complimentary dinner dance given annually by the Manufacturers' Association on Wednesday evening was the last of the social features and officially closed the Conference. Egmont S. Smith, chairman of the manufacturers committee,

Host	Sec'y-Treas.
M. B. Cunningham	*Geo. J. Rohan**
Supt. and Engr.	*Supt.*
Dept. Water and Sewerage	*Water Dept.*
Okla. City, Okla.	*Waco, Tex.*

**A 100 membership gain by the Section a noteworthy first year record for the new Secretary.*

presided at the dinner and introduced the old and new officers, all past recipients of the Fuller Award from the Section and the awardee selected for 1943.

Technical Sessions

Following the customary opening formalities presided over by President L. A. Jackson of the Southwest

Nat'l. Director
Thos. L. Amiss
Supt. and Engr. Dept Water and Sewage
Shreveport, La.

Vice-Chmn.
A. H. Ullrich
Supt. Filtration Water Dept.
Fort Smith, Ark.

Section, H. Lloyd Nelson, Principal Engineer, Water Division, Office of War Utilities, War Production Board, from Philadelphia, Pa., explained the Program of Conservation of the Board, particularly as it would apply to water departments and their personnel.

The afternoon technical session was opened with remarks by the presiding officer, Acting Dean Edward R. Stapley of the Oklahoma A. and M. College, on the importance of the problems to be presented. This session proved to be of exceptional interest.

"Hot Water Tank Corrosion — From the Waterworks Man's Standpoint" was covered by L. C. Billings, Superintendent and Chief Chemist, Water and Sewage Treatment, Water Department, Dallas, Texas.

Types of construction used in domestic hot water tanks were described. The two general methods of heating are by either applying the heat to a coil of copper water pipe in the base of the tank or by direct application of heat to an area of the tank. Use of several different metals such as zinc, iron, copper and brass in contact with one another was decried as tending to set up galvanic action, and as being unscientific and hazardous to the extended life of the equipment. Thermostatic controls on tanks usually involve the use of brass and copper. The use of inlet and outlet tubes of brass constitutes a grave mistake. The use of metals, alloys and glazed metal surfaces may offer future possibilities but does not provide a present solution for the many water consumers now having galvanized iron tanks in service.

Corrective treatment of the water by municipalities and water companies appears to be the best way of relieving the situation. Treatment with alkalies will reduce excessive CO_2. Deoxygenation is possible but not usually practicable with domestic supplies. Dependence on calcium carbonate deposits in the case of softened waters may be deceptive due to the lack of necessary silicates to make them dense and non-porous. With a porous scale water dissolved oxygen may reach the metal and corrosion continues. Recent investigations seem to point to the fact that silicates are necessary to make so-called carbonate scales give effective protection.

A study of the use of sodium silicate in the prevention of red sediment formation in galvanized hot water tanks was made by the Dallas Water Department. Tests indicated that 8 p.p.m. or more of sodium silicate was needed with the Dallas water to inhibit corrosion. However, the cost of $4.16 per million gallons for this treatment appeared incommensurate with the benefits achieved.

Starting in September, 1940, during the winter period of high oxygen content in the water the use of sodium hexametaphosphate was studied. An application rate of 0.50 p.p.m. to the plant effluent was maintained until April 1st. The rate was then reduced to 0.25 p.p.m. for two weeks and then discontinued as the dissolved oxygen concentration decreased from 9.7 p.p.m. to 7.9 p.p.m. during this period. This lower oxygen concentration appeared not to be noticeably aggressive. The sodium hexametaphosphate was fed by the "wet method", using an Omega Precision Feeder, to the filter plant effluent immediately after filtration.

By determining metaphosphate residuals it was ascertained that the treatment had reached all points of the system. An adaptation of the Truog and Meyer Modification of Denige's Colorimetric Procedure was used in testing for the residual metaphosphates. To observe results obtained three water heaters of 45, 30 and 20 gallons capacity, and all in actual service, were under constant observation during the period of the treatment. Bottom sediments were drawn weekly and hot water taps watched for red water discharge. These same heaters had also been under observation during the preceding year when the hexametaphosphate was not being used.

Use of the hexametaphosphate treatment resulted in a greatly decreased number of customer complaints registered and little or no sludge or red water observed from the observation tanks. The unit cost of treatment was 72.6 cents per million gallons as compared to the cost of $4.16 previously noted for the sodium silicate treatment. It is planned to continue the sodium hexametaphosphate treatment of the Dallas water during the cooler months when the concentration of dissolved oxygen becomes excessive.

Trustee
Edw. R. Stapley
Act'g Dean
A. & N. College
Stillwater, Okla.

Pub. Comm.
B. G. Cole
Supt. Filtration Water Dept.
Monroe, La.

In his discussion of this subject "From the Manufacturer's Standpoint," Mr. R. W. Hanson, representing Bastian, Morey, Inc., La Porte, Ind., related various steps in hot water tank development and improvement. He told of various experiments which had been made on the protection of such tanks including the use of controlled electric current. Larger capacity tanks to provide more hot water storage, and more watchful temperature regulation to reduce the tank temperatures were advised as the best assurance of longer tank life.

The subject of **"New Developments in Split Treatment in Water Softening"** was ably handled by J. D. Walker, Chief Engineer, American Well Works, Aurora, Illinois. The meaning of "split treatment" and past practice therein was reviewed. Treatment with an excess of lime followed by recarbonation was mentioned as an accepted practice. Such treatment, it was pointed out, usually results in slow incrustation of the filter sand due to crystallization of calcium and magnesium compounds on the sand grains.

A more recent and improved method of treatment was then described. "Split Treatment" of the water with an over dosage of lime to one part is followed by settling and continuous removal of precipitates. Next is a thorough rapid mixing with the untreated portion, secondary return slurry and activat-

ed carbon, together with all of the soda ash. This is followed by slow mixing for stabilization and floc formation and then settling. The settled effluent is so stable as not to require recarbonation before filtration.

At Ann Arbor, Mich., a plant being operated according to this method was stated by Mr. Walker as giving excellent results in degree of softening possible and a water without incrustation or aggressiveness. At Ann Arbor approximately 75 per cent of the water is given the initial lime treatment, with the caustic alkalinity being raised to about 70 p.p.m. in excess, resulting in a pH approximating 10.8 to precipitate the magnesium hydroxide which starts precipitating at pH 10.3. Keeping the hydrogen ion concentration as low as permissible results in discharging the magnesium to the solubility limit and prevents the formation of soluble basic complex magnesium compounds.

At this plant slurry (sludge) from the secondary settling tank (principally calcium carbonate) is recirculated to maintain about 1½ per cent settleable solids in the *secondary* mixing basin. This slurry will not increase the water hardness by the formation of complex magnesium compounds, since nearly all of the magnesium present is in the sulphate form. Tastes and odors are not to be expected since 75 per cent of the putrescible matter is deposited in the first stage. The activated carbon added to the second stage avoids tastes resulting from the small amount of organic matter that might be in the recirculated secondary slurry. The final settling period is 84 minutes.

Programmers

L. C. Billings
Supt. Treatment
Dept. Water and Sewage
Dallas, Tex.

Thos. F. Wolfe
Research Engr.
C. I. Pipe Ass'n
Chicago

This same general plan with only slight variations was also adopted for the large Ford bomber plant at Ypsilanti. Both plants are equipped to feed CO_2 if necessary, but neither plant finds recarbonation necessary.

Mechanism of Operation: In mixing the two portions of water in the second stage the excess lime causes the untreated portion to give up much of its hardness, and tends to neutralize excess alkalinity. Water from the first stage, greatly supersaturated with hydrates and carbonates, readily deposits its excess load on moving contact surfaces. For instance, the impeller of the rapid mix equipment is rapidly coated with glass-like calcium carbonate.

Agitation of the recirculated calcium carbonate brings the large surface area of the particles in intimate contact with the supersaturated solution. The latter gives the appearance of exploding in its haste to deposit its unstable compounds on the slurry particles. The enormous amount of recirculated slurry in its process of settling acts as a filter to the upward moving liquid in the settling basin. This action results in an effluent of very low turbidity without need for long settling periods.

A great deal of valuable information on the process and the results to be expected was obtained from jar tests at the company laboratory. The water used contained 250 p.p.m. hardness with 22 p.p.m. of magnesium. Calcium carbonate slurry collected from a standard blanket type softening plant of single stage operation was used as the contact material in one series of tests. Pure prepared calcium carbonate was used in a duplicate series to furnish a comparison with water stabilized with a slurry containing an accumulation of magnesium hydrate.

The jar tests indicated the relative merits of each step in the process. Although little difference in resulting total hardness of the effluents was noted, the akalinity and pH were somewhat lower in the case of the effluent from treatment with the pure calcium carbonate. The tests demonstrated that blanket contact alone is not as effective as mixing, and that rapid to violent mixing gives a better stabilized water than slow mixing. Sludge blanket depths of 3 to 6 feet, and slow mixing periods of either 20 to 60 minutes, seemed to have little effect on the results.

An undesirable operating condition observed at some slurry recirculation plants is a milky appearance in the settling tank effluent. This has been blamed in some cases on the use of alum as a coagulant with the formation of H_2Al0_3 from $Al(OH)_3$. It is suggested that this acid state may result in the repelling of oppositely charged particles, resulting in the colloidal dispersion of $CaCO_3$ instead of its coagulation as expected.

A disadvantage of the "split" treatment method is that only calcium and no magnesium is removed from the 25 per cent portion. Usually this will not be high enough to give any problem when mixed with the other three-fourths of the supply.

In an interesting follow-up discussion, Dr. O. M. Smith, Head of the Department of Chemistry at Oklahoma A. and M. College conducted a Question and Answer Period with Mr. Walker, which may be summarized briefly as follows: Standard purification and softening plants may be converted to this method of providing a means of splitting the flow in a simple diversion box, and either adding another series of mixing and flocculating tanks or converting part of the sedimentation capacity to the additional mixing and flocculation units required. Best results will be obtained if the influent liquor enters the tank at or near the bottom so as to take advantage of the "blanket filtration" while securing also the best flowing through efficiency. The system does not differ basically from so-called commercial blanket type softening units in its use of slurry recirculation and blanket contact, but the split treatment would require a minimum of two units to provide overtreatment of one portion in one unit and then mixing all of the water in a second unit.

Under the title of **"How War Time Emergencies Are Being Met By the Water Superintendent,"** G. L. Fugate, Chief Engineer, Water Department, Houston, Texas, described many operating procedures and economies forced on the water department of his own and other cities by the exigencies of the war time period.

Programmers

G. L. Fugate
Chief Eng'r
Water Dep't.
Houston, Tex.

Everett M. Jones
Gen'l Mgrs.
Simplex V. & M. Co.
Philadelphia, Pa.

Oklahoma City's New Project

Tuesday's sessions were presided over by past-president M. B. Cunningham, Sup't. and Eng'r. of the

Oklahoma City Water Dept., and were devoted largely to papers on various phases of the **"Design and Construction of the Oklahoma City Bluff Creek Supply Project,"** presented by several officials and engineers intimately connected with it. City manager H. E. Bailey opened with a general discussion of the project. V. V. Long, consulting engineer, presented a general description of this newest addition to Oklahoma City's water supply system, and C. E. Bretz of the Long organization described the design and construction of the 48-inch cast iron force main on the project.

To replace the cancelled general inspection tour of Bluff Creek on Tuesday afternoon, Stoner McClelland, resident engineer on the project, with the aid of Charles McMahon, official photographer, showed many views taken during the progress of construction. These pictures, many in color, not only showed many interesting and informative details connected with the work but constituted beautiful examples of photographic art.

(It is felt that the size of this new Oklahoma City project and the problems presented in its design and construction merit a special article and illustrations, and because of paper limitations the Oklahoma City Project will not be covered in this report.—E. R. S.)

Other papers scheduled in the morning meeting were **"Special Design of Cast Iron Pipe and Method of Manufacture"** by Thomas F. Wolfe, research engineer, Cast Iron Pipe Research Association, Chicago, Ill., and "General Discussions" by S. W. Freese, of Freese and Nichols, hydraulic and sanitary engineers, Ft. Worth, Texas, and Porter J. Preston, consulting engineer, Denver, Colo.

Under the general heading of "War Time Water Works Information", Wednesday morning's program was given over to a discussion of "Priorities", "Utilities Excess Material", "Selective Service Regulations", "War Man-Power Commission", "The Internal Security Program of the Army", and "The Facility Security Program of the U. S. Public Health Service" by civilian representatives of various government agencies and army officers.

The afternoon session was devoted to "Public Health". In a paper on **"Water Supply and the Public Health"**, A. H. Ullrich, chemical engineer of the Ft. Smith, Ark. Water Dept., stated that medical men advise us to drink plenty of water—but that water must look good and taste good. He stated that safety factors are needed, since water that is past the plant is past control. He advocates both standby equipment and methods. Vacuum breakers at high points in mains, having repair crews open hydrants before draining mains, thorough disinfection of new mains and repaired sections, elimination of cross-connections, adequate testing, and checking for all possible sources of secondary contamination rather than relying entirely on chlorine residuals in the water were recommended.

"The Revised U. S. Public Health Service Drinking Water Standards" were reviewed by Major O. C. Hopkins, sanitary engineer with the U. S. Public Health Service, Dist. No. 7, Kansas City, Mo. He discussed the value of 100 ml. samples as against 10 ml. samples. The allowable amounts of various poisonous elements in the finished water were given. He called attention to the importance of taking a necessary minimum number of samples from the distribution system each month. Subjects included in the new manual he considered particularly worthy of mention were a list of sanitary defects of a water system, the protection of reservoirs and intermittent service. He considered the lack of suitable protective plumbing ordinances in cities as being particularly lamentable.

In the discussion of the subject, **A. B. Jewell,** asst. supt. of the Tulsa, Okla. Water Dept., gave as 2 the minimum number of coliform organisms which might be detected with 5-10 ml. samples as against 1 in 100 ml. samples. Therefore the larger samples should give much greater statistical accuracy —at least hypothetically they should. That the new standards emphasized the importance of obtaining samples of water as actually reaching the consumer rather than at the plant alone was pointed out. **Frank Taylor,** filtration engineer of the Oklahoma City Water Dept., stated that the city's distribution system had been analyzed and 12 fixed points selected for its 250,000 population, samples for residual chlorine and bacterial tests being taken 3 times weekly at these points. He believes fixed points for sampling are preferable to changing points. Dr. O. M. Smith, head of the chemistry department at Oklahoma A. & M. College, questioned the advisability of basing the number of samples to be taken in terms of the population. For example, if only 1 sample per month is to be taken for a city of 2,500 people, what check is there on the water during the remaining 29 days. He felt that cadmium should be included in the list of poisonous elements since it is close to arsenic in this respect.

"Blueprint Now" for the Future

The importance of the "Blueprint Now" program for cities was stressed by E. L. Filby, field director of the Joint Committee on Water and Sewage Works Development of the four participating water works and sewerage organizations. He stated that it was estimated that a period of 6 months to 1 year would elapse between the close of the war and the resumption of peace time activities. The construction of sanitary and other public works will be needed to fill the gap. An appraisal of needs and development of a program of improvements listed in order of importance was recommended as imperative. A reappraisal should be made at once of authority under which construction can be carried out and of ways and means by which the necessary funds may be provided, particularly for the engineering involved in making surveys and plans. Needed land for plant and reservoir sites should be obtained now.

"Latest Developments and Automatic Controls for Water Purification Plants" was presented by Everett M. Jones, general manager of the Simplex Valve and Meter Co., Philadelphia, Pa. He described the importance of and need for automatic or semi-automatic controls in large plants to produce the large quantities of high quality water needed, particularly in those now serving the many varied war industries. He described briefly the latest rate-of-flow, pressure, water level, sand expansion and other gages and plant control devices. Control mechanisms were stated to now be capable of bringing all parts of the plant in step within 4 minutes.

It is with sincere regret that we could not print Prof. Stapley's report written at our request for our November issue. The inability to expand the issue made it necessary to hold and re-schedule this report and certain others which we are attempting to print in the same chronological order as the meeting dates.—L. H. E.

PNEUMATIC CAULKING OF PIPE JOINTS

And Other Water Main Construction Practices at Allentown, Pa.

By H. WALTER HORN
Construction Engineer
BUREAU OF WATER
ALLENTOWN, PA.

ALLENTOWN, PA., a city of 100,000 persons, has a municipal water supply acquired in 1869 at a cost of $98,958 when it had only 10 miles of water mains. Today, the system is valued at $6,800,000 and has 170 miles of mains.

The size of these mains is set by city ordinance and they must be laid according to specifications. In excavating, the contractor is required to hold to the line and grade established by the city engineering department. Where rock is encountered, it must be removed to a depth of 8 inches below subgrade and replaced with padding, compacted in 4-inch layers. When the subgrade is ready, bell holes are dug in advance so the pipe-layers will not be hindered. The pipe, which has been placed alongside the excavation, is rolled into position, swabbed out, and lowered into the ditch either by tripod or ropes. Particular attention is paid to the unloading of the pipe. All pipe is hauled by contract on flat bottom trucks, and removed from the trucks by skids and ropes. No pipe is allowed to be dropped or rolled from the truck.

Joint Packing

After the pipe is placed in the ditch, a single strand of square braided jute is put around the spigot end of the pipe, and the pipe is then "pushed home." If the jute is properly placed and held, it has a tendency to roll into the bell, thus reducing the amount of packing needed. Another advantage of this type of jute is that it centers the spigot in the bell, thereby reducing wedging, which would place a strain on the bell and spigot.

After the pipe is brought to grade by placing a specified 2-in. x 6-in. x 16-in. block behind the bell, the joint is ready to be packed. The jute is driven into the bell to a depth of two and seven-eighths inches, the depth of lead specified for all joints. A round runner or snake is placed in position and the joint is poured in one operation. After the runner is removed, the joint is ready for caulking.

Pneumatic Caulking Adopted

A search of the literature, in 1935, for information on the subject of

The Author

air-hammer caulking of lead joints, between two and twelve inches, failed to reveal anything, but the procedure was nevertheless adopted as standard for Allentown. It was decided that an Ingersoll Rand No. 100 air hammer would be used as it is small and light enough to permit a man to handle it easily, while running the joint in a smooth and continuous manner. A set of caulking tools, consisting of a cutting-in chisel and six other tools of standard sizes, completed the outfit. Caulking hammer and tools are shown in Fig. 1.

The first problem was to determine the amount of air pressure that could be carried without damaging the pipes. By experiment and observation, the following table of pressures was chosen for the work:

Pipe Size	Max. Pressure
12-in.	65 p.s.i.
8-in.	60 p.s.i.
6-in.	55 p.s.i.
4-in. (and less)	50 p.s.i.

These pressure readings are taken at the compressor and not more than 150 ft. of air hose is used.

Any person with a little mechanical ability can acquire the knack of air-hammer-caulking. In practice, every tool that fits the joint is used, beginning with the cutting-in chisel and following with each tool in successive size, from small to large, with one pass around for each. When a joint is properly caulked, the lead gate will practically fall off. Figs. 2 and 3 show the caulking tools in use.

After all pipes are laid and caulked, the line is filled very slowly with water, in order that the chlorine sterilizing agent (placed in every other section) will be completely dissolved. Air is expelled from the pipe at the high point during the filling process. When filled, the line is isolated and tested at 150 pounds hydrostatic head. While under this pressure, the joints are carefully inspected, as a perfectly dry joint is required. If the test is satisfactory, the line is flushed thoroughly and put into service.

Bedding and Backfilling

In backfilling the ditch, particular attention is paid to the bedding of the pipe. A layer of earth is placed in the ditch until even with the top of the pipe, and enough water is run in to make a good puddle. A man in

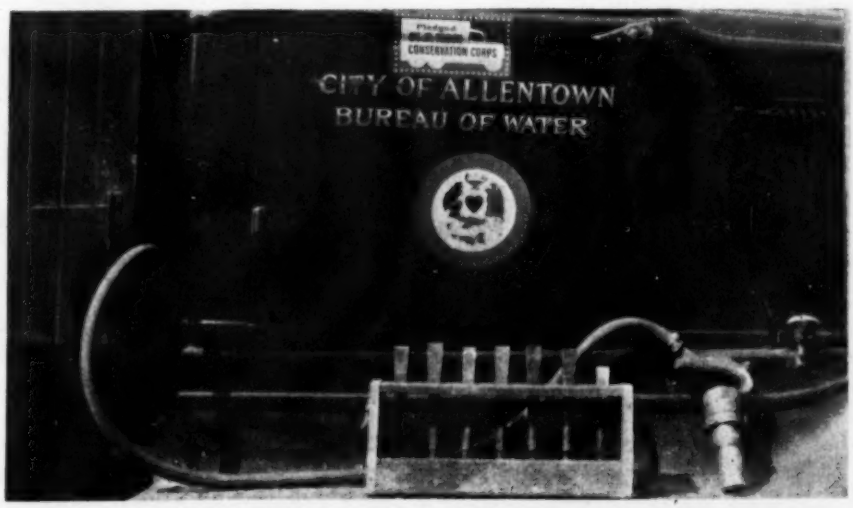


Fig. 1—Caulking Hammer and Tools on Compressor Running Board.

Fig. 2—Caulking a 12-In. Line on Bridge

boots then straddles the pipe and, moving along slowly, stamps and spades the earth until the pipe is well bedded. Following this operation, several methods are used to backfill the rest of the ditch. If done by hand, enough water is used in backfilling to pack the ground well until it is within 18 inches of the top of the ditch. Dry earth is used to complete the filling after which the whole is rolled by truck.

In some instances, especially W.P.A., hand tamping was used from the top of the pipe to the top of the ditch. If the backfilling is done mechanically, a foot of earth on top of the pipe is mandatory before a bulldozer or shovel can go to work. Rock larger than a man's head may not be used in the backfill. Where there is rock formation, mechanical backfilling is not permitted. After the ditch is filled and rolled, the Water Department's work is completed. The City Highway Department makes the permanent repairs to the streets, but the cost is assumed by the Water Department.

Results From Pneumatic Caulking

Since 1935, when air-caulking was introduced into the specifications, twenty-eight miles of water mains have been laid. The success of air-hammer caulking is indicated by the fact that out of approximately fourteen thousand joints, only six 12-in. and three 8-in. had to be dug up and recaulked. Of these fourteen, three of the 12-in. joint leaks were directly attributed to an inexperienced caulker working in adverse conditions. In no instance, has a fractured spigot or bell been discovered due to over-caulking. On several jobs air-caulking was permitted on two, three, and four-inch pipe. Needless to say, an experienced caulker was needed for this work.

Fig. 3—Caulking an 8-In. Line in Trench.

In a recent city wide leak survey, no leaks or cracked pipes were discovered on any of the mains laid since 1935. Any ill effects that might have been due to air-caulking, certainly would have shown up in that time.

Lingnor of the Navy

Larry Lingnor may not have sufficient time before Japan gets what's in store for her for him to become Commodore Lingnor, U.S.N., but he's on his way up the ladder.

What we said to Larry when Uncle Sam called on August 23, 1943 and Larry left his job with us, selling space in WATER WORKS & SEWERAGE and other Gillette magazines, to enter the Navy was this. "As you well know, Larry, space is getting scarcer and scarcer in WATER WORKS & SEWERAGE, but just as soon as you win something to decorate that left arm with we will want a picture to show our readers that 'Lingnor of the Navy' has started on his way to becoming an Admiral".

Well, in today's mail came the accompanying picture of Larry with his new stripes—Storekeeper/3c, Great Lakes Ships Co. His present official rating and location is—

Lawrence H. Lingnor, SK/3c
Recruit Issue Bldg. "O"
U. S. Naval Training Station
Great Lakes, Ill.

Those amongst our readers who know Larry and Mrs. Larry (Dorothy) will be interested to learn that she will be working in our Chicago office for the duration, or at least until Larry returns to his old job which is for the present being handled by our "old reliable" Ed. Hickey, who is carrying double while Larry's away.

L. H. Lingnor

Author Parkes With Los Angeles—Not Pasadena

In our October issue the article "Disposal of Sludge in Small Plants" carried the by-line G. A. Parkes, Ass't City Engineer, Pasadena, California.

This is a regrettable error, which can only be explained by the fact that Mr. Parkes is a resident of Pasadena, as the letter accompanying the article indicated, and unfortunately his connection with the City of Los Angeles was not shown on the manuscript.

Mr. Parkes' correct title and position is—Civil Engineer, Div. of Sewer Design, Bureau of Engineering, City of Los Angeles, Calif.

[*We sincerely regret that this mistake was made, to the embarrassment of Mr. Parkes, and at this opportunity make a plea to contributors to leave nothing to the imagination of editors when it comes to showing the title and position of the author.*—ED.]

RECIRCULATING FILTERS FOR TREATMENT OF SLAUGHTERHOUSE WASTES

By E. F. ELDRIDGE
Engineering Experiment Station
MICHIGAN STATE COLLEGE
EAST LANSING, MICH.

A HIGH-RATE recirculating filter was constructed at the Telfer Packing Company, Owosso, Michigan, during the winter of 1941-42. The results of operation are of interest since they demonstrate a further adaption of this filtration process to the treatment of industrial wastes.

The Telfer Packing Company is typical of a large number of comparatively small slaughter-houses and packing plants that are spread through the rural sections of much of the country. It is located on the outskirts of Owosso and does not have access to the municipal sewer system. The wastes from the factory are discharged into a small ditch which finally empties into a fair size stream. Previous to the installation of the filter, a severe odor nuisance existed in the ditch.

Some years ago the management, in an effort to correct the nuisance, installed a septic tank for the treatment of the wastes from the killing floor. This tank, although reducing the pollution caused by the wastes, accentuated the odor nuisance. The Experiment Station was asked to advise the management as to the necessary facilities to correct this condition.

The preliminary survey indicated that the septic tank should be included in the new installation, since it was already in existence and could be used to remove a considerable portion of the organic load. A high rate recirculating filter was then designed to follow the plan shown in Fig. 1. This filter was to receive the effluent from the septic tank.

The Filter

Recirculating filter installations for the treatment of high-B.O.D. industrial wastes require a holding tank of considerable capacity, if high percentage removals are to be obtained. This tank lengthens the filtration period to 24 hours from the usual 8-hour day. It provides a dilution for the high-B.O.D. waste so that the loading applied to the filter is not excessive at any time. It, also, serves to keep the filter inoculated with active material for the oxidation of the organic solids.

The Author

Such a filter installation also requires a settling tank for the removal of the large quantity of solids which are continuously leaving the filter media.

In the Telfer Packing Company installation, the effluent from the settling tank enters a holding tank that has a capacity of 4200 gallons. This was the maximum daily flow of waste after segregation of clear water. Subsequent changes, however, decreased this holding period as will be explained later.

Waste was pumped to the filter by means of a centrifugal pump delivering 48.8 gallons per minute. The pump was of the horizontal type and was set in a well just outside of the settling tank. This pump was also used to remove sludge from the settling unit.

The filter walls were constructed of silo tile set on a concrete base—See Fig. 1. The filter was 14 feet in diameter and had an area of 154 square feet. The underdrains were composed of lines of half tile with upright tile vents for free access of air, and discharged to a trough that extended about one-third of the way around the inside perimeter of the base. The filter media was composed of 6 feet of hard granite rock screened to 3 or 4 inches. The waste was applied by means of a rotary distributor.

The filter effluent flowed to a settling tank with a capacity of approximately 2,000 gallons. This capacity provides a 40-minute settling period at the rate of application of 48.8 g.p.m. The settling tank was equipped with a hopper bottom and sludge piping.

From the settling tank, the waste passed into a weir box where a portion equal to the rate of raw waste flow passed over the weir to the sewer. The remainder entered the holding tank for further application to the filter.

This filter was designed to follow the plan shown in Fig. 2.

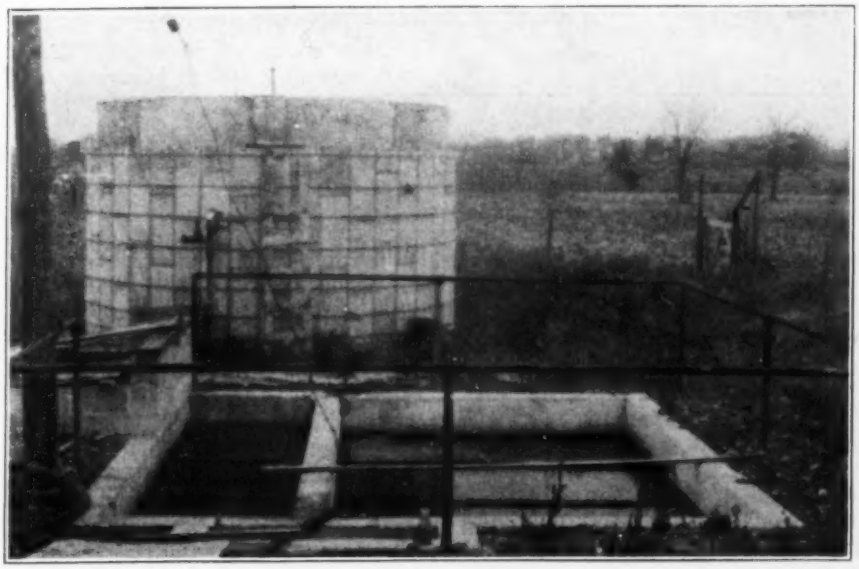


Fig. 1—Holding and Settling Tanks in Foreground Recirculating Filter in Background.

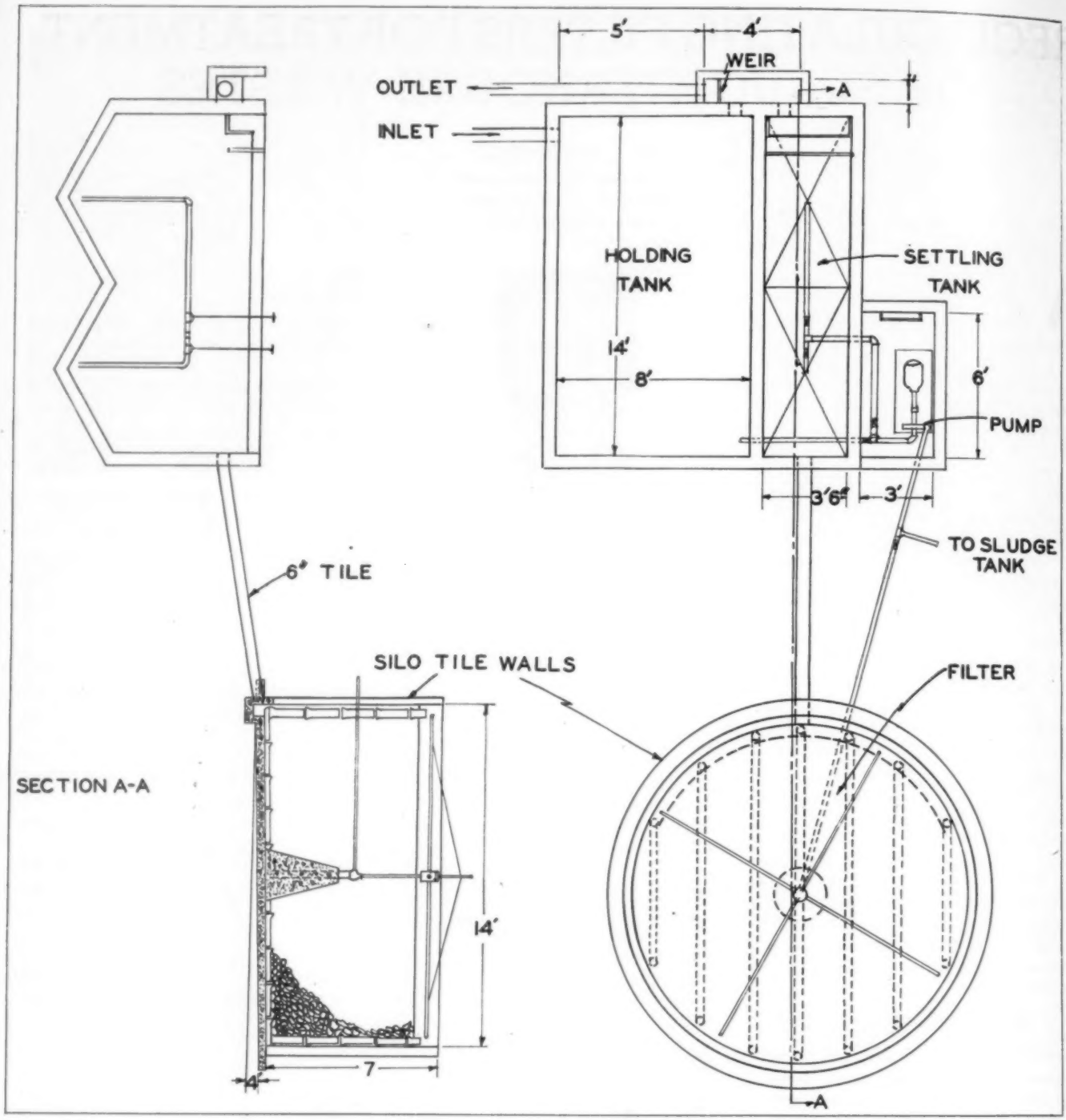


Fig. 2—Line Drawing of Recirculating Filter at Telfer Packing Co., Owosso, Mich.

Operating Results

A two-day survey was made September 22 and 23, 1942, to determine the effectiveness of the treatment installation. The killing operations in the house on these dates were as follows: September 22, 15 cattle. September 23, 5 cattle, 4 lambs and 27 hogs.

The volume of raw waste going to the septic tank was 4200 and 3070 gallons per day for the respective dates. One operating condition existed at this plant which rather complicates the reporting of the results although it apparently does not change the plant efficiency. During the summer, the management decided to pipe the cooling water from the ice machine into the holding tank, with the idea of providing a considerable quantity of fresh water. This was not a recommendation of the Station; but, since it did no apparent damage and may have some desirable effects, no change was made in the arrangements. The rate of flow of this water was constant at 11,200 g.p.d.

Table I shows the analytical results of the survey. The values marked with the asterisk (*) have been corrected to correspond with the volume of raw waste. For instance, the actual B.O.D. values of the final effluent on the two dates were 5 and 12.5 p.p.m. respectively. Correcting for the dilution due to the ice machine water, these values on a comparable basis with the other data become 18 and 57 p.p.m.

TABLE I

SURVEY DATA, TELFER PACKING COMPANY
RECIRCULATING FILTER

	September 22			September 23		
	Raw Waste	Septic Tank Eff.	Final Eff.	Raw Waste	Septic Tank Eff.	Final Eff.
Total Solids, p.p.m.	5042	3566	1962	5058	3822	1916
Total Volatile, p.p.m.	2762	1672	460	2364	1536	352
Suspended Solids p.p.m.	1160	1364	28*	420	1344	23*
Suspended Volatile, p.p.m.	1032	940	18*	332	880	14*
5-day B.O.D., p.p.m.	2200	750	18*	1750	725	57*

* Corrected for volume difference, see text.

Table II shows the volume and B.O.D. loadings to both the septic tank and filter unit. The septic tank reduced the B.O.D. load by 66.1 and 58.8 per cent, respectively.

TABLE II

LOADINGS

	September 22	September 23
Septic Tank		
Volume, gal. day	4,200	3,070
B.O.D. influent, lbs. day	77.0	44.8
B.O.D. effluent, lbs. day	26.3	18.5
B.O.D. removed, lbs. day	50.7	26.3
B.O.D. removed, per cent	66.1	58.8
Filter		
Volume, gal. day	15,400	14,270
Rate, m.g.a.d.	20	20
Times recirculated	4.5	4.9
B.O.D. influent, lbs. day	26.3	18.5
B.O.D. effluent, lbs. day	0.6	1.5
B.O.D. removed, lbs. day	25.7	17.0
B.O.D. removed, per cent	97.6	92.0
B.O.D. loading, cu. ft. lb.	35.0	50.0
B.O.D. loading, lbs. cu. yd.	0.77	0.54
Over-all B.O.D. removal, lbs. day	76.4	43.3
Over-all B.O.D. removal, per cent	99.2	96.6

The filter loads on the volume basis were 15,400 and 14,270 gallons per day. The rate of application was constant at 20 m.g.a.d. The number of recirculations were 4.5 and 4.9. The percentage reductions through the filter were 97.6 and 92.0 per cent. The loadings on the two dates were 0.77 and 0.54 pounds of B.O.D. per cubic yard of filter stone. Interestingly the lower efficiency was obtained with the lower loading. In view of the limited data, this is not significant.

The over-all removal of B.O.D. by the plant was 99.2 and 96.6 per cent respectively for the two dates.

Comments

This report is presented merely to demonstrate the effectiveness of the high-rate recirculating filter as a means of treatment for slaughterhouse wastes. The management of this factory is entirely pleased with the installation. The cost of filter and tanks, not including the septic tank, was less than $600.00. The cost of operation is limited to the power consumed by the pump and a few hours of labor occasionally to dispose of the sludge. The sludge is hauled to a field about once a week. The odor nuisance has been entirely eliminated.

History Repeats Chlorine Cylinders Again Short

Last November we ran in these columns a plea by R. J. Quinn of the Mathieson Alkali Works for chlorine users to return empty cylinders promptly. Apparently that plea has been forgotten in the last few months, for Mr. Quinn, speaking for the clorine industry, again writes that ". . . it is the shortage of cylinders for transporting chlorine that is the chief problem associated with its wartime availability. It is almost impossible to get new cylinders because of Government allocation of steel and a large proportion of cylinders already in existence have been diverted to the armed forces. Chlorine or chlorine compounds are vital in guarding health by assisting in sanitation measures, in the purification of drinking water, in preventing spoilage of foodstuffs, in medicinal preparations, and in the manufacture of many other strategic chemicals.

"Manufacturers, fortunately, appear able to produce sufficient chlorine, and we believe that there are enough standard steel cylinders to take care of essential users, *if* cylinders are kept in circulation. It is easy to set an empty cylinder aside and forget about it, but doing so under present conditions may mean delay in meeting a vital war need. It thus becomes increasingly imperative to keep reminding all purchasers of chlorine to return cylinders for refilling as quickly as possible."

"Blueprint Now for Tomorrow's Needs"

A booklet with the above title has been prepared by the Committee on Water and Sewage Works Development, a group composed of representatives of NEWWA, FSWA, AWWA, and WSWMA.

Prepared for the direct purpose of bringing the idea of "Blueprint Now" to municipal officials and public spirited citizens concerned with civic post war plans, this booklet should be helpful in the development of constructive projects which will be of permanent benefit to any community.

A subtitle on the front cover, "The Importance of Water and Sewage Works in Your Post-War Plans" states the general theme of the booklet. Realizing that today's No. 1 job is to win the war, the booklet nevertheless points out that "it is our bounden duty, here safe in America, to plan *now* for the peace". The booklet proceeds to develop a challenge to those who plan for tomorrow and presents the case for water and sewage works development.

This general theme of the importance of water and sewage works in post-war planning is developed in several sections of the booklet under the following headings: "City Growth Depends on Water and Sewage Works", "Are You Ready for the Great Post-War Home Market?", "Protecting the Health of Present and Future Residents", "The 'Good Neighbor' Policy Begins at Home", "Protection Against Man's Common Enemy", and others.

The booklet also contains comments on water and sewage works as the forerunner to other public improvements and public works that pay for themselves.

Of particular interest in the booklet are two check lists containing 12 questions each, one on water works, and one on sewage disposal. These check lists ask pertinent questions which will develop the possible needs for revision or improvement in either a water works or a sewage system.

SEWAGE WORKS FEDERATION TAKES A STRIDE

The Second and Concluding Installment of a Report Covering the Record Size Fourth Annual Meeting of the Federation

IN OUR November issue part one of this report told of the progress made by the three-year-old Federation of Sewage Works Association in membership growth and of its improved financial status to a point which permitted the Board of Control to vote the necessary funds for establishing a full time staffed headquarters and editorial office and the employment of Secretary Wisely henceforth on a full time basis as Executive Secretary and Editor.

The first installment embraced digests of those papers presented in the early technical sessions of the Conference and this installment continues the reporting.

Central States Association Holds Business Luncheon

At the luncheon and business meeting held by the Central States (Host) Association there was considerable elation shown when Secretary John Mackin reported a gain of 108 new members during the year. The joy in the Central States Camp was occasioned by the fact that this gain of 108 members exceeded the quota set and put the Association, with its now 495 members out ahead of the New York Association which for many years could boast that it was the "World's Largest Sewage Works Association." Now the honor goes to the Central States group—more important, it shows what a hustling Membership Committee can do when the incentive is there. New York trails with 478 members.

At its luncheon session the Central States Association elected the

Central States Officers

President	Sec'y-Treas.
Don Bloodgood	*John Mackin*
Prof. Sanitary Eng.	*Superintendent*
Purdue Univ.	*Sewage Works*
Lafayette, Ind.	*Madison, Wis.*

following officers for the year ensuing.

President

Don. E. Bloodgood, Purdue Univ., Lafayette, Ind.

1st Vice-President

W. D. Hatfield, Decatur San. Dist., Decatur, Ill.

2nd Vice-President

E. J. Beatty, Captain, Sanitary Corps., U. S. Army.

3rd Vice-President

Paul Riedesel, Minn. Dept. of Health, St. Paul, Minn.

Secy. and Treas.

John C. Mackin, Madison San. Dist., Madison, Wisc.

The member representing the Association on the Federation Board of Control is B. A. Poole, former Chief Engineer, Indiana State Dept. of Health, now serving as Major in the Sanitary Corps of the Army.

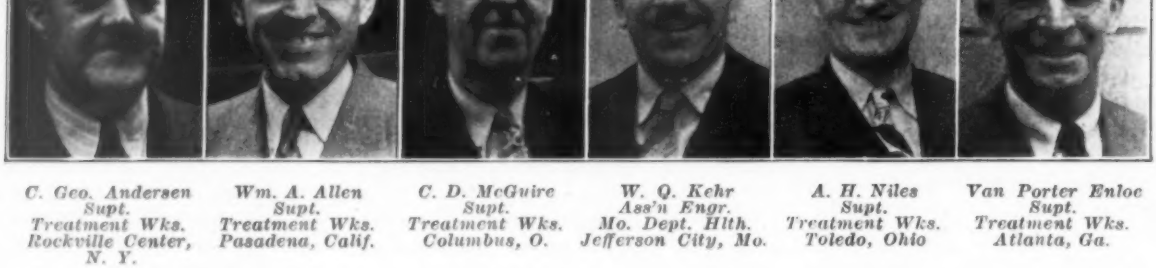
Federation Papers and Discussions

"The Significance of the Finding of the Virus of Infantile Paralysis in Sewage—A Review," by Kenneth F. Maxcy, M. D., and Howard A. Howe, M. D., Professor and Associate Professor of Epidemiology, School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, Md.

In a comprehensive and critical manner, Doctors Maxcy and Howe reviewed the present knowledge of this timely subject. Their paper was presented by the junior author. As important considerations, it was noted that during the last few years a change has taken place in ideas of the portal of entry of the virus (not through the olfactory mucosa but through the mucosa of the alimentary tract); it has been demonstrated that the virus may be present in the intestinal discharges of patients or carriers; and, even by the still relatively crude methods of virus recovery, it has been shown that the virus may remain active in sewage for considerable periods of time.

The authors commented on recent laboratory studies in which attempts were made to evaluate methods commonly employed in water purification for their ability to remove or inactivate the virus of infantile paralysis. Sedimentation, coagulation and filtration are considered to be inadequate for this purpose. On the basis of published studies, however, there is no basis for concluding that chlorination is not effective for inactivating the virus. Active virus has been recovered from municipal sewage in a number of instances, but only once

Federation Directors



C. Geo. Andersen	*Wm. A. Allen*	*C. D. McGuire*	*W. Q. Kehr*	*A. H. Niles*	*Van Porter Enloe*
Supt.	*Supt.*	*Supt.*	*Ass'n Engr.*	*Supt.*	*Supt.*
Treatment Wks.	*Treatment Wks.*	*Treatment Wks.*	*Mo. Dept. Hlth.*	*Treatment Wks.*	*Treatment Wks.*
Rockville Center, N. Y.	*Pasadena, Calif.*	*Columbus, O.*	*Jefferson City, Mo.*	*Toledo, Ohio*	*Atlanta, Ga.*

has it been recovered from drinking or swimming pool water, and that sole exception is of questionable significance according to present knowledge. However, failure in this respect must not be considered to prove the innocence of these as means of transmission.

Typhoid fever and cholera are diseases which can be correlated with the pollution of water supplies. An abrupt decline of incidence of these diseases has followed the adoption of improved water treatment methods, or an increased incidence has resulted when treatment facilities have failed. This relation provides evidence for the acceptance of such diseases being waterborne, but there is no such evidence for concluding infantile paralysis to be waterborne. If it is assumed that filtration and chlorination are ineffective in removing or inactivating the virus, then the incidence of infantile paralysis should have increased with increasing water pollution; this has not occurred. There is no single explosive outbreak which can be attributed to a water supply.

The virus has been recovered from trapped house flies, usually in dirty neighborhoods, but the most probable source of fly contamination remains to be determined. The authors conclude that still other means of virus transmission may exist, such as spread by droplet infection. Research in this field is providing much epidemiological evidence, but not yet sufficient to determine an adequate method of controlling the spread of infantile paralysis.

"Effect of Various Treatment Processes on the Survival of Helminth Ova and Protozoan Cysts in Sewage," by Eloise B. Cram, Senior Zoologist, National Institute of Health, U. S. Public Health Service, Bethesda, Md.

The author has attempted to evaluate various sewage treatment processes under controlled laboratory conditions, to simulate their effect on the viability of ascaris (a large round worm of the intestine), lumbricoides ova (a dog hookworm) and the cysts of the protozoa amebic dysentery. These diseases are not normally of serious significance but are likely to become of increased importance as infected persons return from foreign countries where such diseases are prevalent. A sharp rise in the incidence of tropical diseases of this type followed the last war. In a preliminary study of a considerable number of sewage sludges, Miss Cram found those from municipal sewage treatment plants to contain no worms, while one-third of sludge samples from army sewage treatment plants did contain worms.

Laboratory studies of primary settling showed the intestinal worms to be absent from the effluent (upper layer of sewage) after fifteen minutes; settling, however, did not remove hook worm ova or cysts. In an experimental trickling filter, there was no correlation between removal of five day B.O.D. and of cysts, but a high degree of removal was accomplished; the removal of hook worm ova was less satisfactory. In studies of activated sludge treatment, ameba cysts proved viable up to 48 hours, ascaris worms remained viable up to five months, and hook worm continued to develop in the effluent.

During secondary settling, cysts were still present in the top layer; chemical precipitation during this stage proved very effective in accomplishing effective sedimentation. In sand filtration, a 12-inch depth of sand proved insufficient to remove cysts. During sludge digestion, development of intestinal worms was suspended but they remained viable for more than 90 days; development of hook worm ova was likewise suspended but their viability was not destroyed; the cysts of amebic dysentery remained viable during digestion only during 12 days. When digested sludge was dried, the intestinal worms were active up to 180 days, even when sludge moisture was reduced to 10 per cent; hook worm ova developed, hatched, and produced infected larva for a period of more than 60 days.

L. E. Rein
President
"P. F. T."
Chicago

R. A. Anderson
Sup't
Sewerage
Muskegon Heights, Mich.

Clyde C. Hays
President
Hays Proc. Co.
Waco, Texas

H. J. Mecker
Manager
W. & S. Division
Worthington
N. Y. City

E. Hurwitz
Prin. Sanitary Chemist
Chic. San. Distr.
Chicago

Grant Olewiler
Sup't
San. Drainage
Merion Tw'shp
Ardmore, Pa.

C. O. Baetz
Sup't
Treatment Wks.
Appleton and Neenah, Wis.

[Time did not permit free discussion of this paper, but Miss Cram attended the Operators' Breakfast Session the following day for the purpose of answering numerous questions.—Ed.]

"Grease Removal at Army Sewage Treatment Plants," by Rolf Eliassen, Major, Corps of Engineers, North Atlantic Division, New York, N. Y.

Major Eliassen described sewage received at army treatment plants as containing grease ranging from 25 to 250 ppm., a high concentration which proved somewhat surprising to plant engineers and operators. The preparation of foods and the large use of soap account for such an amount in sewage entirely domestic in nature. Although grease traps, properly operated, will accomplish the removal of about half of the grease, that remaining still has a major effect on trickling filters and activated sludge treatment processes.

As a primary means of grease removal, the grease may be removed as scum, or as sludge, or it can remain in the middle layer. The problem investigated is to find a method of increasing the efficiency of removal by either sedimentation or flotation. The best criterion of grease removal appears to be provided by analyses of raw sewage and of the primary effluent.

Three different types of equipment for increasing grease separation are employed in certain army sewage plants: preaeration by diffused air, mechanical preaeration, and aeration with vacuum flotation.

Major Eliassen presented the results of statistical averages of a very large number of samples and by means of slides showed a graphical comparison of the per cent removal accomplished with sewages of widely varying grease contents.

The studies indicated essentially that preaeration by diffused air or by mechanical aeration gave a very slight increase in the amount of grease removed by sedimentation. The addition of chlorine, generally in a 5 ppm. dose, to the aeration step gave no apparent increase in the amount of grease removed. Neither was the addition of chlorine to aeration preceding vacuum flotation of any apparent benefit. The author made it clear that these somewhat surprising results, that neither preaeration nor aerochlorination was of apparent value in accomplishing increased removal of grease in primary sedimentation, are based on studies which apply only to army camp sewage. The mass of data presented can be fully reviewed only when this paper is published in full.

C. M. Stanley, President, Stanley Engrs., Muscatine, Ia. — *K. C. Lauster, Chief Engr., St. Dept. Healt., Bismarck, N. D.* — *S. B. Davies, Pres. & Mgr., Royer. Fdy., Kingston, Pa.* — *R. J. Quinn, Sales Mgr., Mathieson, New York* — *Fred Eidness, Sanitary Engr., St. Dept. Health, Jacksonville, Fla.* — *Ed. R. Stapley, Dean of Eng., A & M College, Stillwater, Okla.* — *"Vic." Ehlers, Chief Engr., St. Dept. Health, Austin, Tex.*

Operator's Forum

(John C. Mackin—Chairman)

Under leadership of John C. Mackin, Supt. of Treatment Works, Madison, Wisc., the "Operator's Forum" followed the "Annual Operator's Breakfast," and occupied the closing half day session of the Wartime Conference. Three major topics were discussed by various speakers in the forum.

Topic 1—The Use of Sludge in Victory Gardens

As leader of this discussion group, A. H. Niles, Supt. of Treatment at Toledo, Ohio, introduced the several speakers.

LeRoy Van Kleeck, Conn. State Dept. of Health, stating that about one-third of the sludge produced in Connecticut was being used on gardens, gave the following "Pointers in Marketing Sludge." (1)—Get your County Agricultural Agent to boost the use of sludge; (2)—Don't expect heavy sludge applications to raise yields proportionately. Fact is the reverse is observed; (3)—For safety it's best to apply sludge for winter lay on the land. Mr. Van Kleeck pointed out that the filter cake of sludge conditioned wth lime drops from a pH of 11 to pH 7.5 in a few days. This sludge is essentially free of B. coli and at Middletown, Conn., has been used for 5 years without raising the alkalinity of the soil above pH 6.9.

David Backmeyer, Sup't of Sewerage, Marion, Ind., in discussing "Use of Sludge in Liquid Form Direct from Digesters" cited this practice at Anderson, Richmond, Muncie and La Porte, Ind., in addition to Marion. The Marion sludge is 100% disposed of in liquid form employing a 930 gal. wooden tank truck equipped with a portable pump. The average delivery distance is 5 mi. @ $1.50 per tank delivered. The Marion sludge, representing a mixture of raw and activated sludge plus garbage digested, runs 8.6% solids; 2% nitrogen; 2.4% P_2O5 a day basis. Therefore one tank load provides 13 lbs. of nitrogen and 15 lbs. of phosphoric acid (P_2O5) at a value of $2.62. Therefore at $1.50 per tank load the buyer has a bargain and the material is delivered and spread for him. The rate of application is 930 gals. (1 tank) to area of 160 sq. ft. On forage crops 7 to 12 truck loads per acre is being applied—somewhat lighter than for vegetable gardens.

Henry A. Riedesel, Sup't at Rockford, Ill., reported use of liquid sludge but only on pasture lands. Efforts to market dried sludge in 100 lb. bags had not met with success and air dried sludge is now given away to the takers.

C. W. Reidesel, Minn. State Dept. of Health, reported on guinea-pig tests with sludge of various ages on the ground. T. B. developed from very fresh raw sludges whereas no disease was contracted from any sludge after more than 2 weeks on the ground.

Dr. Eloise B. Cram, National Inst. of Health, U. S. P. H. S., whose paper on dangers of disease spread from sludge use on the land is digested earlier in this report was questioned concerning the practical aspects of her observations, which in themselves would materially discourage further use of sludge as a soil improver. She said that hookworm was the most important consideration in the south and that amoeba were alive 10 days after inoculation of the digested sludge. The concentrations of inoculating materials were much higher than anything to be experienced in practice and no conclusions or rules could be set for the present. She, however, did not believe the matter of too much importance for the present but in the future with return of soldiers from war service in tropical lands the question of sludge disposal might have to be given closer scrutiny. In answer to a question she said that no tests had been made with heat dried sludge.

A member made the remark that if sludge disposal on the land was a really dangerous practice it would be hard to explain how anyone could be left in China after these centuries of fertilization with human excrement.

Topic 2—Secondary Treatment—Present and Future

As leader of this discussion group, John C. Mackin, Sup't, Treatment Works, Madison, Wisc., introduced the speakers.

A. S. Bedell, Chief, Bureau of Sewage Disposal, N. Y. State Dept. of Health opened with a review of sewage treatment progress in the United States representing better than 5,000 treatment plants serving more than one-third of the country's population. At least 45% of the treatment plants now provided some form of secondary treatment. Particularly impressive were the statistics for N. Y. State in which 47 plants in 1917 had grown to 269 in 1940 and 35% of this lot provided

secondary treatment. Mr. Bedell then enumerated the several secondary processes and what each could be expected to accomplish. Included in these "secondaries" he named ponds and their effectiveness in removing 88% of the organic matter

Manufacturers' "Brass Hats"

Dan S. McAfee
Gen'l Manager
The Dorr Co.
New York
(President W&S Mfrs. Assn.)

W. "Bart" Marshall
Mgr. Sanitary Sales
Chain Belt Co.
Milwaukee
(Chairman, Sewerage Div. Exec. Comm.)

and remarkable bacterial reductions secured in ponding.

Don J. Walker, Sanitary and Development Engineer, American Well Works, Aurora, Ill., in discussing high vs. low rate trickling filters pointed out the greater overall removal of oxygen demand by the high-rate filter whereas the stability of effluent was poorer because the job stopped short of ammonia oxidation to nitrates. The flexibility of combinations of high and low rate filters permitted the designer to choose the secondary process on the basis of the extent to which nitrogen oxidation was to be requisite and cost justification. The choice between high rate filtration and short period aeration in activated sludge would largely become a question of economics.

Mr. Walker said that the very effective sand filters of long standing had the disadvantage of large areas and the shortcomings of poor distribution of the applied sewage and ineffectual utilization of the complete sand bed. Work being done on raising the efficiency of distribution to sand filters had been yielding interesting and highly practical results with less media than heretofore considered feasible.

In discussing the newer decolloidizing processes Mr. Walker had concluded that, with more liberal design than originally provided, the Hayes Process could be expected to produce satisfactory results.

A. W. West, Sanitary Engineer, Lancaster Laboratories, Hackensack, N. J., and until very recently with the Wisconsin State Health Dep't, was requested by Chairman Mackin to review the features of the Mallory Oxidized Sludge Process, which he did. He compared the trial and error methods of operating control of the activated sludge process of former times and limitations inherent to plant design with the Mallory method of design for the all important combination of flow *and* strength of sewage. Inasmuch as both of these values go up and down together, the past failures to take this combined loading effect (physical and biochemical) into consideration in the original design and include provisions for flexibility in process control had been cause for deficiencies in operating results and economies. The greatest feature of the Mallory method of design based on demonstrable formulae was that *all* factors were taken into consideration. In operation, the ease and exactness with which the balance between sludge in storage (final tank sludge blanket) and sludge in circulation was maintainable represented the operating feature of the Mallory method of control. It seemed possible to operate at all times with but 5 to 10 ppm. of suspended solids in the effluent at all times, and in event the sludge blanket becomes disturbed and begins to rise in a reasonably short period the sludge balance can be restored. These were essentially the features of the Mallory Methods.

L. H. Enslow, Editor, *Water Works and Sewerage,* New York, in performing a rounding up operation of the discussion on Secondary

Committee Chairmen

(Program and Publications)
F. W. Gilcreas
N. Y. State Dept. Health, Albany
(Registration)
Kenneth V. Hill
Greeley and Hansen, Engrs., Chicago
(Publicity and Attendance)
*Edward J. Cleary**
Managing Editor, Eng. News-Record
New York
**Also featured luncheon speaker*

Treatment said that it seemed evident that some form of dilution of the stronger sewages was beneficial whether the process be high-rate filtration or some form of activated sludge. He had often preached the advantages of having a creek crossing on a trunk sewer where controlled sewage dilution might be practical in dry weather when sewage strength and staleness became a problem. Long years ago this controlled dilution advantage had been established at the Aurora, Ill. sprinkling filter plant. Amongst other things a serious odor nuisance

Stalwarts

Langdon Pearse
Ch. Sanitary Engr.
Sanitary Distr.
Chicago
(Chairman, Local Host Committee; Made Honorary Member Central States Assn.)

Arthur S. Bedell
Bureau Chief
N. Y. State Dept. Hlth.
Albany
(Federation Past-President; General Policy Committee Chairman)

had been corrected. The present high-rate filters were an example of the worth of effluent recirculation in case of need—seasonally if not continuously.

Mr. Walker's comments on the highly efficient and reliable sand filter had the ring of sound reasoning. The development of such units with efficient distribution of the applied liquor would be watched with interest—especially in connection with its usefulness in the smaller plants where high degree treatment is indicated.

What Mr. West had said concerning the Mallory Oxidized Sludge Process, methods of plant design and process control deserved more than passing note. Anyone who had seen the Mallory method put to test on such difficult waste as creamery effluents and how it functioned even with indifferent control supervision; and then had seen how promptly the Ann Arbor, Mich., plant could be brought back to even-keel performance and how simple the control method is, it was to be highly impressed. Any such method certainly deserved attention. Mr. West had been rather conservative in his statements when considering the extent to which he had checked into the Mallory Control Indices when applied to plants producing dependable and consistent results and those which had not.

All in all the designing engineer now has the greatest variety of processes to choose from that has ever existed and stream demands can be more economically met than ever be-

fore and it is no longer necessary to provide more or less in the way of treatment than sound engineering dictates. Significant in this direction had been the enormous savings to Minneapolis and St. Paul when only primary treatment was provided as the year in and out treatment with facilities for chemical precipitation incorporated in the design for use when river flow conditions indicated the need for higher degree treatment. Result is that in the several years of operation the river has never "hit a low" which justified anything beyond primary treatment under high grade supervision.

The above comment would answer Mr. Emerson's question—"Are we going too fast in the degree of treatment provided? And don't we need some revision of old standards into standards of the day."

Dr. Hatfield (Decatur, Ill.), raised the question if the key to many of our sewage treatment ills may not be provisions for recirculation of effluent or other form of controlled dilution of sewage ahead of secondary processes in general? It looked very much that way from where he sat.

Morris Cohn, Editor *Sewage Works Engineering,* was in agreement that the practical solution would appear to be some degree of treatment of every gallon of every sewage and industrial waste—but in every instance a minimum of treatment to meet the individual stream requirement. In addition the stream might in instances be fitted to the effluent. It is assumed that Mr. Cohen was considering the possibility of stream or lake diversion to augment the flow of other streams, or the construction of storage dams to bleed during low water extremes for producing more uniformity of dilution, as is being put to use in western Pennsylvania and northern West Virginia at present.

Topic 3—Wartime Operating Problems

As leader of this discussion group, Wm. J. Downer, Ill., State Dep't of Health, introduced the speakers. Mr. Downer stated that only two men had been left in the Sanitary Eng. Div. of the Ill. Dep't of Health —that was their problem.

Major Rolf Eliassen, Engineer Corps., U. S. Army, N. Y. City, revealed that some Army plants actually suffered from industrial wastes. While laundry waste was common, photographic wastes had also proved a problem with serious effects on activated sludge. Silver salts and hyposulphite were the disturbing substances—the first an antiseptic and the latter played havoc with the essential oxygen in the aeration process. T. N. T. wastes had been successfully treated on trickling filters. Supernatant liquor from digesters had proved the universal problem. Sludge drying bed deficiencies had proved a bottle neck and to relieve this condition alum added to the applied sludge going onto the beds had proved a life saver in cutting draining and drying time. Major Eliassen told of Camp Imhoff tanks constructed of lumber, which were O. K. except that most of the sewage left through the tank sides and bottom until finally the tanks were sheet lined.

Martin A. Milling, Sr. San. Engr., Indiana State Dep't of Health, said that it had been a problem to keep certain Indiana cities from shutting down their treatment plants for the duration as an economy in the war effort. During the period of critical materials shortage Indiana Sewerage Departments had spent less than 2 cents per capita on such materials. The smaller plants had not been properly served because of the lack of knowledge and understanding of the operators in making applications for priority assistance. Mr. Milling reported that there were in Indiana 14 activated Sludge Plants, 43 Trickling Filter Plants, 3 Bio-chemical and 19 Plain Sedimentation Plants, serving 60% of the urban population of the state.

The last speaker in the group discussing "Wartime Plant Operating Problems" was **Edw. C. Cardwell,** Sanitary Engr., Truax Field, Madison, Wisc., who in recounting problems at Truax Field had found such to be essentially the same as those of any other treatment plant operating under wartime conditions and subject to fluctuating and high peak loadings.

Conservation Program of W.P.B.

H. Lloyd Nelson, Special Engineer of the Water Division, W.P.B., explained to the group the broad outline of the nation-wide voluntary water and power conservation program. He stressed the fact that stopping water waste in homes is vital and necessary not only because it reduces the load on the water plant, and therefore conserves power, fuel and materials, but also because it likewise reduces the volume load on the sewage plant and therefore conserves more power, materials and equipment on the "Used Water" end.

W.P.B., said Mr. Nelson, does not ask that anyone or any plant give up essential or needed services or supplies. It only asks that waste be eliminated from all phases of public service, and that all men in public service aid in bringing this conservation program to the attention of the public served.

Chlorination of Sewage and Wastes. Grease Separation Newest Use

"The Chlorination of Sewage and Industrial Waste—A Critical Review," by Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

Mr. Faber presented a summary of the past and present applications of chlorination in the field of sewage and industrial waste treatment, and attempted some evaluation of its future utility. Those applications which may at present be considered as well established ones are: disinfection, B. O. D. reduction, and control of odors and septicity.

There is a real need for fundamental research, particularly in the newer applications of chlorine. Studies which lead to refinements of present practice would be amply justified by improvements in plant operation and by economy of chlorine. One example cited was that of Buffalo, where laboratory studies by Symons so improved plant control that a dosage increase of only 18 percent was required when the chlorine demand of the raw sewage increased 28 per cent. As an example of B. O. D. reduction through chlorination, the careful plant scale studies and research of Baity at Chapel Hill, N. C., disclosed several practical benefits. A convincing example described by Rawn of Los Angeles County, Calif., illustrates the desirability of controlling septicity by up-sewer chlorination: by this expedient the capacity of an activated sludge plant was increased four-fold. Subsequently Houston, Texas, reported a similar experience with chlorination at an activated sludge plant.

Other applications developed in recent years include the use of chlorine for control of activated sludge bulking, for correcting the ponding of trickling filters, for rendering activated sludge thickening practical, and for the removal of grease from sewages and industrial wastes. In certain plants these applications have been proven to be thoroughly successful, while in others they have not. Apparently further study of chlorine reactions and of means for their control is necessary in order to make uses generally applicable.

Mr. Faber described the development of a new process utilizing chlorine for the treatment of wool

scouring waste and profitable recovery of grease. Only after detailed study was devoted to the physical, chemical, and biological characteristics of this waste had it been possible to properly control the treatment. It is essential to treat this waste in a fresh condition and to apply the chlorine in the form of hypochlorite rather than as liquid chlorine. The process is odorless, the effluent is acceptable from a pollution point of view, and the recovered grease can return a profit. Two woolen mills are constructing plants to utilize such treatment.

Among other applications in treatment of industrial wastes, chlorination has proved an effective means for destroying toxic cyanide compounds.

Perhaps the full possibilities of chlorination are not more widely utilized because the process is mistakenly regarded as such a simple one. New applications promise to modify and control the action of chlorine by using it in combination with air, or as hypochlorous acid, or as an alkaline compound, or with metals. Mr. Faber stated that the oxidation characteristics of chlorine made of it a useful treatment aid, subject to exact evaluation at the particular sewage or waste treatment plant experiencing operating problems in which the control of biological and chemical phenomena might be assisted seasonally or continuously through the moderate use of chlorination in one or another form.

Symposium on Post-War Problems

(Reported by H. A. Faber, Editorial Associate)

Leader, Morris M. Cohn, Editor, *Sewage Works Engineering,* and Sanitary Engr., City of Schenectady, N. Y.

Mr. Cohn, whose publication started a Committee for Postwar Sanitation headed by the Editor, described a ten-year plan of sewage and industrial waste treatment which would set a goal of 6,000 sewage treatment plants and industrial waste treatment plants to be built or reconstructed in the post-war period. This can be done at an estimated cost of two billion dollars. He stressed the fact, however, that plants on paper are necessary before there can be plants on the ground.

Methods of financing must be worked out by municipalities themselves, instead of awaiting federal support. Many such programs are already being energized to provide employment for a part of those men for whom employment must be provided when the war is ended. Private industries are planning for peace as they build for war, and the public works field should have definite plans under way.

"The Consulting Engineer and Post-War Planning," by C. A. Emerson, Havens and Emerson, Consulting Engineers, Cleveland and New York.

Preparation of this nature is not new to consulting engineers, who prefer the term "advance planning" to post-war planning. Advance planning involves neither risk nor unwarranted expenditures; it does involve the preparation of plans and specifications with possible new developments in mind.

Funds can be made available for needed construction if the plans include local financing of sewage treatment plants. The trend of sewage treatment will not soon be changed by new developments, since manufacturers have had little opportunity during the war period to develop new processes or equipment. In order to make a reasonable forecast of post-war population or industrial changes engineers must devote careful study to local conditions.

"The Canadian Point of View," by A. E. Berry, Director, Sanitary Engineering Division, Ontario Dep't Health, Toronto. (New Vice-President of the Federation.)

The Canadian government has appointed a "Committee on Reconstruction" which, with the cooperation of engineering groups, stresses the need for concerted action to provide public works. Water works and sewerage programs are already imperative. Surveys show Canada to have nearly 1,300 water systems, serving about 60 per cent of the population, and some 500 sewered municipalities of which 115 have sewage treatment plants.

Considerable progress is now being made in the blueprint stage, with some preparation for construction before the war is over. About forty million dollars is the estimated requirement to provide immediate needs for water and sewage treatment plants. Municipalities are now empowered to set aside funds for these future uses, and simple methods have been developed for financing such construction.

"Post-War Projects of Sewage Works Equipment Manufacturers," by W. B. Marshall, Chain Belt Company, Milwaukee, Wisc. (Chairman, Sewage Works Division Executive Committee of the Manufacturer's Ass'n.).

Mr. Marshall recognized that some engineers and municipal officials hesitate to put plans on paper because they expect new developments in plant equipment to appear after the war. In his opinion, only gradual and evolutionary changes of this nature will occur; however, he presented the results of a survey of manufacturers to provide concrete evidence.

Question: "Could an engineer specify your product with reasonable certainty that immediate post-war improvements would not be upsetting?" *Answer:* "Yes, 100 per cent." *Question:* "Do you intend to market any new product for immediate post-war use?" *Answers:* "No, 50; yes, 2." *Question:* "Do you have definite intentions of marketing any radically new sewage works product at some time in the post-war period, after adequate time for development, testing and marketing plans?" *Answer:* "Over one-third replied yes —but this would be a normal expectation."

It seemed plain therefore, that blueprinting and specifications could go forward on sewerage projects without any anticipated revisions before the actual bid letting after the war.

"Aims and Methods of Operation of the Committee on Water and Sewage Works Development," by E. L. Filby, Field Director, Committee on Water and Sewage Works Development of the F. S. W. A., the A. W. W. A., the N. E. W. W. A., and the Water and Sewage Works Manufacturer's Association.

(Note: This committee should not be confused with the committee organized by *Sewage Works Engineering* under Mr. Cohn's guidance and chairmanship.—Ed.)

Mr. Filby explained that the Committee on Water and Sewage Works Development has been founded to meet the need for guidance in the development of water supplies and the disposal of wastes. It is necessary to appraise needs now in order to present specific plans to governing bodies. An orderly program must then be developed to meet these needs and, finally, the plans should reach the stage indicated in the slogan "Blueprint Now!"

The Committee expects to consider and hopes to develop practical methods for financing, believing that every community can meet its own needs without expecting Federal assistance which the depression brought into being as an emergency procedure. A survey of 659 U. S. cities disclosed that 414 already have plans for sewer and sewage plant construction totaling 274 million dollars; there are more projects of

this nature planned than is the case for water plants, airports, etc.

"A Municipal Post-War Sewerage Project" was described by Clyde L. Palmer, Associate Engr., Dep't of Public Works, Detroit, who told of the establishment of a Civil Sanitary Division within Detroit's Bureau of Sewers for the principal purpose of planning sewerage betterments for Detroit and its contiguous area. A master plan is being developed for sewerage and storm drains in immediate post-war period, wherein 75% of the projected (ultimate) requirements are to be installed then and 25% will follow as the need arises. If Mr. Palmer gave any details of projects planned or estimate of overall costs we failed to hear the figure but it was apparent that much is needed in the nature of sewers and storm drains in the Detroit area.

Milton P. Adams, Exec. Secy. and Engr., Michigan Stream Control Commission, Lansing, Mich., reported that for Michigan he had submitted to his Commission a list of needed sewage and industrial waste treatment plants requiring expenditure of $50,000,000. Therefore Michigan should be well represented in post-war treatment plant construction. All of this construction is expected to be completed during the first year after the war is won. He noted that the recent resolutions publicized by the Izaak Walton League presupposes that federal aid is to be forthcoming in the immediate post-war era.

L. R. Howson, Chicago Consulting Engineer, noted the desirability and many times the feasibility of treating industrial wastes in a combination treatment plant operated by the municipality. Some industrial waste would require a special plant operated by the manufacturer, of perhaps the city. In any case cooperation between the municipal authority and the manufacturer was highly desirable as sound practice technically and economically. The possibilities and advantages in financing the plant and its operation with industrial monetary aid were too great to overlook in all future waste treatment planning.

Several questioners from the floor wished to know how all of these desirable treatment plants were to be financed. V. M. Ehlers, veteran chief engineer of the Texas State Dept. of Health, stated that legislation to permit debt increase by Texas municipalities would be required before anything of concrete nature could be projected. Mr. Ehlers and others (Daley of Chicago San. Dist.; Bloodgood of Purdue Univ., et al.) voiced the opinion that the Committee on Development had an added job of establishing a legal procedure of securing necessary funds where existing bond debt limits have been reached and financing through a Sewer Rental System is not legalized or is not supported by the required public vote.

Michael Baker, Jr., Consulting Engineer, Rochester, Pa., reported that municipal finances are probably in better shape than in years in most states. For instance, 4th class cities in Pennsylvania (about 400 of them) have the ability at present to borrow up to $500,000,000 under the existing 7% debt limitation. Many municipal bonds have been retired in recent years and the "pay as you go" system is taking hold.

Several pointed out that in Connecticut legislation permits cities and public utilities to set aside surplus funds for post-war projects and development.

Milton Adams reported that Michigan was off to a good start by legalizing municipal spending from surplus for engineering and other services in drawing plans and specifications for post-war construction.

Lloyd Nelson, W.P.B. Engineer, loaned by U. S. Pipe & Fdy. Co., stated that by and large U. S. cities have a really worthwhile backlog of surplus which *can* be drawn upon for post-war betterments—and particularly where the project is to be self-supporting as can be so for water supply and sewage disposal, particularly if jointly financed.

34 Sewage Works Exhibitors

The following 34 firms were represented in the exhibit hall of the recent Conference of the Sewage Works Federation in Chicago, October 21-23, where the registration of 614 proved a new record for the Federation's annual meetings:

American Cast Iron Pipe Co.
American City Magazine.
American Well Works.
Automatic Control Co.
Builders-Providence, Inc.
Ralph B. Carter Co.
Chain Belt Co.
The Chapman Valve Mfg. Co.
Chicago Pump Co.
Crane Co.
The Dorr Co., Inc.
The Eimco Corp.
Engineering News-Record.
Everson Mfg. Co.
Flexible Sewer Rod Equip. Co.
Graver Tank & Mfg. Co.
Infilco, Inc.
The Jeffrey Mfg. Co.
Johns-Manville Corp.
Lakeside Engineering Co.
Limestone Products Co.
Link-Belt Co.
Monsanto Chemical Co.
Nichols Eng. & Research Corp.
Pacific Flush-Tank Co.
Pittsburgh Equitable Meter Co.
Public Works Magazine.
Royer Foundry & Machine Co.
Sewage Works Engineering.
The A. P. Smith Mfg. Co.
Wallas Dove-Hermiston Corp.
Wallace & Tiernan Co., Inc.
Water Works & Sewerage Magazine.
Yeomans Brothers Co.

Copper in Sewage Retards Sludge Digestion

(A Correction)

In our November installment reporting the Chicago meeting of the FSWA, an ambiguous statement was contained in that portion of the report dealing with the comments of LeRoy VanKleeck on the subject of industrial wastes. The ambiguous and slightly inaccurate statement concerned the presence of copper in sewage and its effect on sludge digestion. Fact is the 10 ppm. of soluble copper was found in the digester liquor and not in the sewage. Evidence indicates the 10 ppm. in the sewage would prove deadly to digestion.

Lest there be any confusion in the minds of our readers, Mr. VanKleeck suggests that we refer to an article by H. T. Rudgal of Kenosha, Wisc., appearing in the Wisconsin "Clarifier" in August, 1943. That article entitled "Digestion Trouble Due to Industrial Wastes Containing Copper" states that "Experiences at Kenosha indicate that if only ½ to 1 ppm. removable copper is present in the raw sewage, sludge digestion will be affected, and may be inhibited appreciably with practically no sludge digestion or gas production taking place. Sludge digestion will practically stop when the copper concentration in the digested sludge reaches 200 to 250 ppm."

This fact that copper in the sewage concentrates in the sludge digester is perhaps somewhat surprising, and indicates that the copper in the sewage must be largely absorbed or taken into combination by the settleable sewage solids. We do know, from some laboratory experiments, that copper salts will precipitate colloidal proteins. This may explain the concentration of copper in the solids. We have also learned of other plants experiencing the same effect. We have also heard of another plant where 0.4 ppm. of copper does not seem to have any effect on digestion.

Mr. VanKleeck points out that chromium, in concentrations of 10 ppm. has been observed in one sewage without affecting digestion, but not so with copper.

THE LITTLE ROCK SANITARY SEWER SYSTEM

Financing Methods, Maintenance and Operational Practices

By T. W. CLAPHAM
Manager
LITTLE ROCK SANITARY SEWER SYSTEM
LITTLE ROCK, ARK.

THE Little Rock sanitary sewer system administration was authorized by an act of the state legislature (Act 132 of 1933) which empowered "cities and towns to construct, own, equip, operate, maintain, and improve works for the collection and/or treatment, purification and disposal of sewage. And to authorize charges against owners of premises for the use of such works and to provide for the collection of same; to authorize cities and towns to issue revenue type bonds payable solely from the income of such works . . . and to make charges against owners of premises therein served, thereby a lien against such premises." Even divested of its lawyer's lingo, that's saying a lot, and gives plenty of rope to hang oneself with as far as troubles and problems are concerned.

In 1936, acting under the authority granted in this act, Little Rock created a sewer committee by city ordinance, issued $926,000 worth of bonds, built a big interceptor sewer, levied sewer charges, and otherwise started the Little Rock sanitary sewer system upon its business career. Since that time problems of administration and operation have arisen and have been solved by the trial and error method until Little Rock now has a sewer system that operates on a fairly smooth basis.

Rate Structures

Because money is the source of all operations (as well as the "root of all evil") let's look at the rate structure first. In the first set-up for rates, the structure was based on an arbitrary flat charge per month for various classifications. For example:

Residences or apartments having 4 rooms or less	$0.15
5 or 6 rooms	0.30
7 or more rooms	0.45
Hotels and boarding houses, per room ($1.00 minimum)	0.05
Stores (retail and wholesale) Less than 50 employees	2.50
50-100 employees	3.75
100-200 employees	5.00
More than 200 employees	7.50
Hospitals (per bed)	0.10
Office buildings (per room)	0.05

The Author

"And—when dead cats are no longer thrown into manholes; when sewer charges are all promptly paid; and, when manhole lids no longer rattle or bang—you and I, gentle reader, will be plinking away on golden harps."

It soon became apparent that there was too much investigation required to be sure that the sewer rates were correct—and people don't like investigation!

Early in 1937 an effort was made to correct the situation by an ordinance in which the rate was based on the amount of water consumed during the months of December, 1936, and January, 1937. The following are examples of the rates:

Water Consumption (Gal. per Month)	Sewer Charge (Per Month)
Less than 2,250	$ 0.20
2,250-3,000	0.25
3,000-6,000	0.35
30,000-50,000	3.50
1,000,000 or more	15.00

While this was a step in the right direction, there were still inequalities. For example, the user of one million gallons per month paid a $15 sewer charge; so did the user of five million gallons. Either the rate was too high for one or it was too low for the other, and the next ordinance fixed the monthly sewer charge at 15 per cent of the average monthly water bill for the preceding year. Under this plan each consumer's water bills for the preceding year were added and divided by 12 to give the monthly average. The sewer charge was fixed at 15 per cent of this amount with a minimum charge of 20 cents and a maximum charge of $100. With a water rate of 30 cents per 100 cubic feet, the charge for a consumer using 6,000 cubic feet of water a year would be—

$$\left(\frac{6{,}000}{12} \times \$0.30\right) \times 0.15 = 23\tfrac{1}{2} \text{ cents}$$

Under this setup, those who used the sewer most, paid most. Manufacturers who alleged that part of their water consumption did not reach the sewers were allowed to install a special water meter to register that part which did not reach the sewer, and due allowance was made when figuring their sewer charge. Certain classes of industry were allowed a 5 per cent flat credit on their water consumption. These included dairies, laundries, hotels, and ice makers.

Matters went along peacefully until the water company dropped the base rate from 30 to 25c per 100 cubic feet. Bingo! Sewer revenue dropped about $1,500 a month and stayed that way for a year until the sewer committee decided to raise the percentage to offset the drop in water rate. The new and present rate is based on 18 per cent of the average monthly water bill for the year 1941. This is supplying revenue sufficient to meet the bonded debt and maintenance costs.

This system is not without its faults, however. For instance, if a family paying a 54-cent sewer charge moves to a house that has a 20-cent rate, they keep quiet about it. If, on the other hand, a family moves from a 20-cent house to a 54-cent house, they dash right down to the office with the first month's bill. An adjustment is demanded and obtained and we lose 34 cents a month income. Inasmuch as the Water Department does the billing and inasmuch as there are about 20,000 accounts, the matter of keeping up with the transfers from house to house is a full-time job.

The Most Logical Method

The next logical and final step will be to base the sewer charge on the metered *amount* of water consumed each month, rather than the per cent

Fig. 1—Pumping Station, Little Rock Outfall Sewer. Capacity 33 m.g.d.—Operates automatically when Arkansas River Reaches 15 Ft. Stage or Higher. Had a Real Test in Recent Floods.

of water bill system. This sliding scale meter record system should not only solve many problems but also please the public. It will do away with inequalities, catch families that move around, and stop a leak in the income. The tentative monthly rate schedule for this system is as follows:

Water Consumption in 100 cu. ft.	Sewer Charge per 100 cu. ft.
4- 100	$0.05
101- 300	.04
301- 600	.03
601-1,500	.02
1,501-3,500	.015
3,500 plus	.01

The minimum charge will remain at 20 cents per month and the maximum at $100.

This rate structure will produce a slight increase in revenue. The present income from approximately 20,000 accounts is $8,500 a month. The forecast income will be $9,200 a month.

It is proposed to place this system of rates in effect in the winter months, because in the winter the average account will show a small decrease from the present rate. By the time summer arrives the public will be accustomed to the idea and will understand the increase in summer billings for sewage service as well as for water.

The Sewer System

The Little Rock sewer system consists of 250 miles of sewers varying in size from 4-inch (yes, 4-inch!) to the 60-inch outfall. Inasmuch as Little Rock's sewage is disposed of by the simple scheme of dispersal into the Arkansas River, the only mechanical equipment is a pump station located at the lower end of the outfall (Fig. 1). This station is equipped with three Fairbanks-Morse pumps, has a capacity of 33 m.g.d., and begins operations when the river reaches a stage of 15 feet.

During the recent flood the pump station was a mere island rising out of the waters which were high, wide, and definitely not handsome. The river stage was 30 ft. The pump pit is 30 ft. deep. Men working in the pump pit were just about thirty feet below the swirling, roily waters of the Arkansas, but the station operated successfully and came through with flying colors.

Because the sewer department had long been a sort of step-child to city administrations, and because city engineers had changed with monotonous regularity, the Little Rock sanitary system had no records to speak of. In fact there wasn't even a map showing where the lines were located. The first step to remedy this situation was a mapping program carried on as a N.Y.A. project.

Using an atlas map, each crew of three boys was given a tracing of an area about four blocks square, on which was platted all available information. These boys then went into the area and opened every manhole, measured the depth, the size of the pipe entering and leaving and the direction of the flow. All their findings were entered on the tracing, and the results later compared with the previous data, before being recorded on the atlas map. Because of the war the project was discontinued when about 80 per cent complete, but it is gradually being finished.

Sewer Inspection

Many of the problems of operating the sewers are undoubtedly caused by faulty construction and slipshod work by irresponsible plumbers making house connections. Formerly there was no one representing the city on inspection of newly finished lines. Nor was there a sewer ordinance that specified anything about the building of sewer lines except that they be buried a certain minimum depth underground. In April, 1942, the city council passed a "sewer ordinance" in an effort to remedy this situation. Although not a model, and probably leaving much to be desired, the ordinance does cover the main problems, and does give jurisdiction over this vital matter of building sewers.

The ordinance requires that plans and specifications for all sanitary sewers must be submitted to the office of the Little Rock sanitary sewer system for inspection and approval, and stipulates that a copy of these plans must be left on file as a permanent record. All pipe used must comply with the current A.S.T.M. specifications for sewer pipe. The maximum distance between manholes is 400 feet, and manholes must be located at every change in grade or direction of the line. Manholes must be at least four feet in diameter. House and service connections must be made of A.S.T.M. specification pipe, joined with suitable compound after being caulked with oakum, and must be officially inspected before being covered. Wyes must be used on all house connections involving lines of 8-in. diameter or less. Connections may be tapped into mains larger than 8-in.,

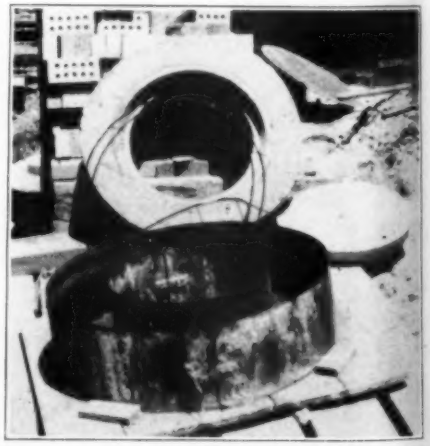


Fig. 2—Home Made Form for Concrete Manhole Rings and Covers. With Completed Ring and Cover in Background.

but they must be inspected before being covered. A sewer permit costing $3 covers the expense of this inspection.

As a contribution to the war effort, Little Rock is now making its own concrete manhole rings and covers (Fig. 2). These are being used where the manhole is not subjected to heavy traffic and are enabling us to re-use the old cast-iron rings and covers in locations where the traffic is heavy. The form for these rings is made from an 18-inch pipe ring borrowed from a local manufacturer of concrete pipe. Both ring and cover are reinforced and have given good service to date.

Sewer Stoppages and Maintenance Work

Little Rock's 250 miles of sewers, varying from 4-inch to 60-inch, are not without their cleaning problems. These troubles consist chiefly of removing foreign matter from the lines and repairing or rebuilding lines that have broken down from one cause or another. Because of the geographical location of the city, sand, gravel, rocks, and roots as well as extraneous matter all find a way into the sewers. Only the lines in public property are serviced. House connections are the domain of the owner and his plumber.

As any operator of a sewerage system can appreciate, the term "foreign matter" covers anything from grandma's teeth to dead cats. We have removed bushels of hairpins, razor blades, marbles, coins, rings, spike-brushes, shoes, pocketbooks (usually empty), light bulbs, and what not. Recently a call was received from the local Coca-Cola Bottling Co. and it was found that someone had carefully inserted the inside container of an ice cream freezer into the outgoing line of the manhole. The water was backed up to a depth of seven feet.

In addition to cleaning efforts, attention is given to the gradual rebuilding of lines that give trouble, and to the correction of reversed grades and pockets in the sewers.

Two crews operate in the maintenance of the sanitary sewer system. These are the "little trouble" crew and the "big trouble" crew (Fig. 3), the former handling all routine stoppages, answering 100 to 135 calls a month. These calls cost about $3 each for labor, material and overhead.

The "big trouble," or construction crew, takes care of the larger cleaning jobs, all construction work, and stoppages too big for the routine crew to handle without interference with ordinary calls.

"Little Trouble"

The "routine" crew consists of a foreman and two men. This crew is given all calls received, and either remedies the trouble, refers it to the other crew, or advises the property owner to call a plumber. All complaint calls are recorded, showing the time received, type of trouble and later the time serviced.

After a call has been serviced a notice is left at the address reporting the trouble. This notice (Fig. 4) either shows that the work has been done or that it is of private nature requiring a plumber. The cost of making the service call and repair is also shown on the theory that the public likes to feel "it is actually getting something for its money." The notice also asks the property owner to help by not abusing the sewer. Carbon copies of these notice reports are filed monthly in the office. This procedure was started in January, 1943, but has had very favorable reaction in a short time.

The three-man crew has a one-ton pick-up truck completely equipped with flexible rods, augers, cutters, ratchets, flat cables, sand, cement, oakum, rope, bucket, tools, first aid supplies, flashlight and two hand-mirrors.

Many of the calls can be handled with the flat cables if manipulation is proper. Using a wad of bailing wire on the end of these cables has been found to be effective in breaking stoppages. Small root growths are readily removed with this method. Large roots must be taken out with the flexible rods and accessories.

For "muck," that gooey, sticky mixture of sand, dirt and filth, the flat cables have proven effective. By rubbing the cable back and forth until just before you lose your religion, the muck will be loosened and "liquefied" to a point where a head of water behind the stoppage will push it on out. If water is not already backed up in the sewer, some is added from a fire hydrant.

In Little Rock, experience has proven that the flexible rods are best where the distance between stoppage and manhole is great, or where the root growth is heavy and where sand and gravel have accumulated. Augers on the flexible rods are effective in the removal of rocks, cans, wood and other items. A rubber cup behind the auger to catch the full force of the impounded water is a great help in forcing the auger through the system.

"Big Trouble"

The "big trouble" crew has two trucks, a 1½-ton stake body truck and a 1-ton pickup. As well equipped as the other truck, and having in addition boots, raincoats, winches with steel cables and Champion type sewer buckets, these trucks can service almost any type of trouble or reconstruct any line. All trucks and equipment, including sand, gravel and cement, pipe, bricks and manhole castings, are housed at a recently acquired garage and storage

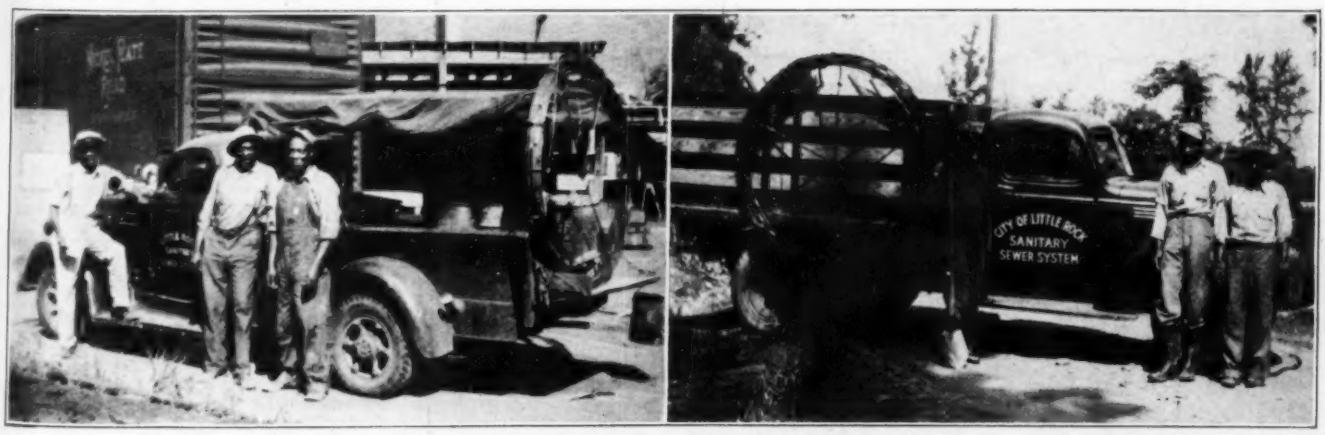


Fig. 3—"Little Trouble Crew." "Big Trouble Crew."

TO THE OCCUPANT AT Date 7-6-43

4821 Crestwood

We have examined the sewer in answer to your phone call.

☐ The trouble seems to be in your PRIVATE line. You should call a plumber at once to prevent unsanitary conditions.

☒ The trouble in the main has been remedied at an expense of $ 3.50. Your monthly sewer service charge enables us to render this service to you.

Please help us to avoid future trouble by keeping matches, rags, greases, and garbage out of the sewers.

LITTLE ROCK SANITARY SEWER SYSTEM

Fig. 4—Specimen Report on Sewer Cleaning Operation.

warehouse separate from other city departments.

Little Rock's peculiar geographic situation gives ample opportunity for almost every kind of sewer trouble. The east side of town is flat, with a sandy, loamy type of soil. The west side of the city is rocky and hilly. Many mains are laid in deep ravines and are naturally subject to being crushed by falling rocks. A broken pipe may lay undetected for several weeks, but when it rains the torrent of storm water that rushes down the ravine will wash rocks and gravel into the line.

As a horrible example, we recently found 14 inches of rock and gravel (ranging from the size of a pea to the size of a man's head) in an 18-inch line. This presented a nice, expensive job of cleaning. The procedure was about as follows: Staging was floated through between manholes, pulling ½-inch cotton rope with it (remember when there was Manila?). The cotton rope pulled the steel cable through and we were ready to go to work. Using winches and a 15-inch Champion sewer bucket that opens its jaws when pulled forward and closes them on the back pull, we gradually ate our way through this block of pipe. From the standpoint of time, this was an expensive job, but when compared to the expense of relaying the line, the cost was small. We have found that the Champion type bucket is about the only effective way to remove this type of obstruction in fairly large lines.

On smaller lines, gravel is removed by the flexible rods with the proper augers and rubber cups. Sand and dirt is removed in about the same manner. Plenty of water behind the rubber cup helps to push the obstruction along to the next manhole where it is removed.

Other foreign matter (that's grandma's "specs," false teeth, pocketbooks, etc.) is removed with the flexible rod and augers. These either bore through and break the obstruction, or mesh themselves with whatever is in the sewer, allowing it to be pulled back to the manhole. Work is usually carried on from the manhole above the stoppage, as this lets the impounded water help break through the stoppage.

Roots—and How!

Roots are removed from the smaller lines (12″ and smaller) with flexible rods and their root cutter augers. These bore thru the root mass which is sheared off by pulling back on the rods. It isn't unusual to bring back a root growth from three to six feet in length, and just about the size of the pipe. In the larger mains, roots are removed with an expanding culvert scraper. This tool expands from 8 in. to 23 in. in diameter, and is pulled through the pipe by winches. Roots are sheared off, and the smaller particles float down to the lower manhole where they are trapped and removed. The larger portions are pulled back to the manhole with the scraper. As an example of the possibilities of this tool, we removed about 5000 pounds of roots from a 24 in. line five hundred feet in length. One of the tap-roots was so large that it took three men to lift it from the manhole!

Those two hand mirrors on each truck are not carried to satisfy the vanity of the crew—for, it has been found that the larger lines can best be examined with the aid of mirrors to reflect sunlight down the main. This gives a bright light that can be sent from manhole to manhole, showing the condition of the pipe. One man stands on the ground and directs the sunlight down into the hole, where the examiner picks it up with his mirror and sends it down the pipe line. All one needs is a bit of sunlight and a couple of ten-cent shaving mirrors. Any one who doesn't use these mirrors is missing a bet, as they give a beam that is far superior to that of the best flashlight.

At present we are experimenting with the use of rubber beach balls for cleaning sewers as practiced in Los Angeles, and reported in the Reference and Data section of WATER WORKS AND SEWERAGE. While we are still inept at this procedure we believe it has possibilities—especially for removing sand and small gravel. If it works, much time will be saved, and a corresponding amount of money will be available for other purposes.

There may come a time when there are no sewer stoppages, and when dead cats are not thrown in manholes. There may be a happy day when all sewer charges are paid promptly, and no one is sued. There may come a time when manholes don't rattle, and people don't call at

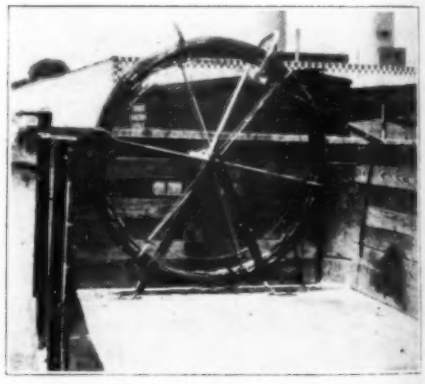
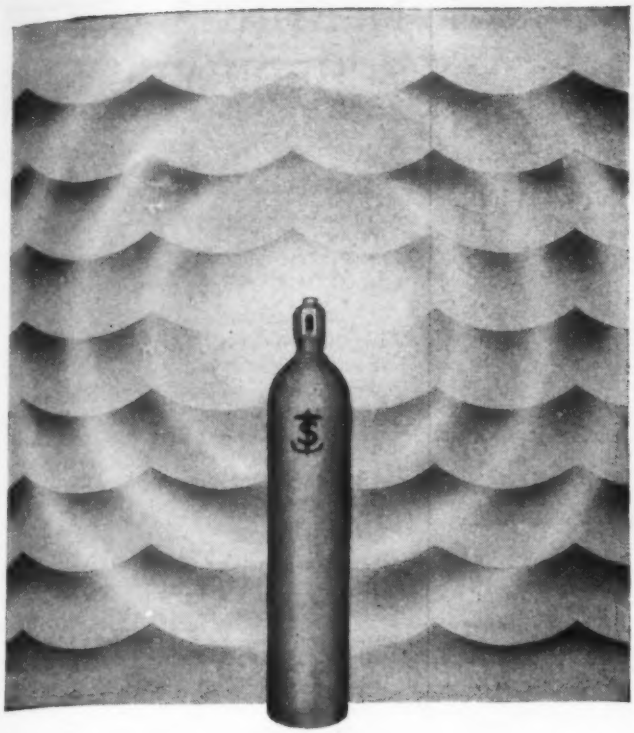


Fig. 5—Method of Using Flexible Sewer Rod Reel in Truck.

midnight to say that every time they flush their toilet the sewage backs out of their bath tub—but when that happens, you and I, gentle reader, will be plinking away on a golden harp, and adjusting our halos at a more comfortable angle. Why am I so sure we'll be in heaven? We can't be anywhere else . . . as sewer men we've already had our hell on earth!



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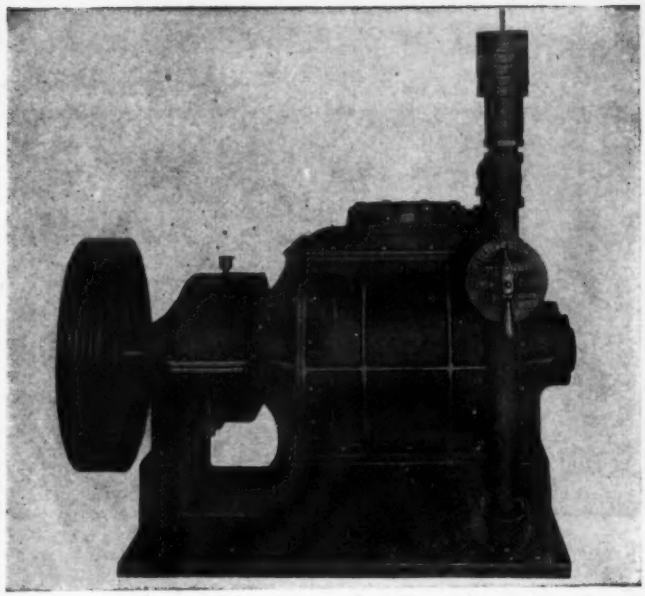

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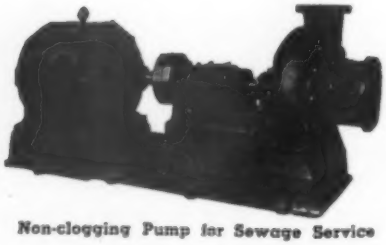
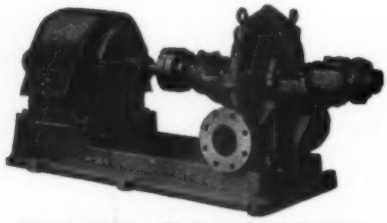


Non-clogging Pump for Sewage Service



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CENTRIFUGAL PUMPS

MEETINGS SCHEDULED:

Jan. 18, 1944—NEW YORK, N. Y. (Hotel Commodore).
New York Section A.W.W.A. (Mid-Winter Luncheon & War Conference.) Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N. Y.

Jan. 19-21—NEW YORK, N. Y. (Eng. Societies Bldg.).
American Society of Civil Engineers. (Annual Meeting.) Exec.-Sec'y, Geo. T. Seabury, Eng. Soc. Bldg., 29 West 39th St., New York, N. Y.
(Sanitary Engineering Div. Sessions, Thursday, Jan. 20th.)

Jan. 20—BOSTON, MASS. (Hotel Statler).
New England Water Works Ass'n. Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass. (Future meetings Feb. 17-Mar. 16.)

Jan. 21—NEW YORK, N. Y. (Hotel to be selected).
New York State Sewage Works Ass'n. Sec'y, A. S. Bedell, State Dep't. of Health, Albany, N. Y.
(Joint Annual Dinner of N.Y.S.S. W.A., and the Sanitary Eng. Div. of A.S.C.E., Friday, Jan. 21st.)

Jan. 31-Feb. 2—COLLEGE STATION, TEXAS. (Texas A. & M. College).
Texas Water Works & Sewage Short School. Sec'y. V. M. Ehlers, State Health Dep't., Austin, Texas.

Mar. 13-17—ST. PAUL, MINN. (Lowry Hotel).
Minnesota Section A.W.W.A. Sec'y, R. M. Finch, Wallace & Tiernan Co., 416 Flour Exchange, Minneapolis, Minn.

Apr. 19-21 — NIAGARA FALLS, ONT. (General Brock Hotel.)
Canadian Section A.W.W.A. Secy., A. E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ont., Can.

Apr. 26-28—JACKSON, MICH. (Otsego Hotel).
Michigan Section A.W.W.A. Sec'y, M. N. Gerardy, Detroit Dep't. of Water, Detroit, Mich.

Apr. 27-28—UTICA, N. Y. (Hotel Utica).
New York Section A.W.W.A. (Spring Meeting.) Sec'y, R. K. Blanchard, Neptune Meter Co., 50 West 50th St., New York, N. Y.

May 17—SPRINGFIELD, MASS. (Hotel not selected.)
New England Sewage Works Association. (Spring Meeting.) Secy., LeRoy W. VanKleeck, State Dep't of Health, Hartford, Conn.

*Here and There with "Doc" Symons**

"Doc."

IT'S NEWS, if you haven't heard it:—W. H. "Honest Farmer" Clark, Supt. of Water at Avon, N. Y., has just completed forty years in that job, and looks forward to forty more.—"Bill" Banks, head of the Newark, N. J., Water Dept., has received word that his son, John, a 2nd Lt., was killed in action on the Italian front in October.—The feminine touch is more in evidence around the AWWA headquarters since Vic Allen and Eric Johnson have gone to war and been replaced by their respective wives. Eric is a Marine at Parris Island, and Vic is at Ft. Dix.—Tom Riddick says the USPHS used to belong to him as a citizen, now he belongs to the USPHS.

* * *

Fred E. Stuart, one of our more peripatetic correspondents writes, that at the No. Carolina Section AWWA meeting, there was a standard at the front of the room which showed the name of the presiding officer and the name of the speaker. Saves latecomers from whispering to that attentive person in the next seat. Sounds like a good idea.

* * *

Applause from the Mid-west. Anent our comments last month about persons who read reports that are too long, Prof. Edward Bartow of Iowa University writes "Just a word of approval. . . . I am reminded of a notice on a program at a meeting of a water works association in Oklahoma in which it stated that if *apologies* and *funny stories* were omitted there would be plenty of time for the paper itself. . . . Another method that should be used to hold down the time limit of speakers is a hard boiled presiding officer. . . ." We welcome Prof. Bartow to our League for Limiting Long Windedness.

* Associate Editor

Better Quarters for Our Fighting Men

America's military establishments of today—with their modern sewage disposal plants—are far ahead of those of 1918 in sanitation and in general appearance; a factor which is today recognized as an important morale builder. At many camps, good stands of grass and shrubs have been provided by converting the sewage sludge into fertilizer by means of Royer Sludge Disintegrators.

Above is shown a Royer at work at a camp of the U. S. Army Signal Corps. As at many posts, it was a real problem here to keep grass growing under thousands of marching feet. Grass was desirable, not only from the standpoint of appearance, but also to keep the men from tramping mud and dirt into the barracks. The soil, which had been used for farm land, was not conducive to growing grass. Something had to be added. The needed fertilizer was present in the sewage sludge at the disposal plant, but proper preparation of the sludge cake was necessary. This was accomplished with the Royer, and satisfactory grass *was* grown.

A large number of municipal sewage disposal plants are profitably converting their sludge into marketable fertilizer with a Royer, which reduces the sludge cake to pea size, aerates and further dries it, at the same time eliminating trash. Royer-prepared fertilizer has been a most helpful factor in this year's good crops and Victory gardens. This rugged, easily-operated machine soon pays for itself in fertilizer sales, and also provides fertilizer for city parks.

Royer Sludge Disintegrators are made in twelve portable and stationary models, in sizes for every plant; electric motor, gasoline engine or belt-to-tractor driven.

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Write for Sewage Sludge Utilization "Datalog" and be prepared to profitably aid America's food production in 1944.

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It was at the annual meeting of NEWWA in Boston where we heard the story about how the Preload Concrete Co. had built some concrete tanks for the Carnegie and Republic Steel Cos. because they couldn't obtain steel.

* * *

It looks as though Filby's Blueprint Now slogan has had a widespread effect. As we write this on Pearl Harbor Day the newspapers are full of stories about Roosevelt, Stalin and Churchill drawing the blueprint now both for the rest of the war and for the post war period. —Notice how in that big three agreement, Frank and Winnie had Joe in the middle when it came to signing.—Afraid he'd get away?

* * *

Almon Fales of Metcalf and Eddy, who gave us some sage advice long years before we deserted the test tube for the typewriter, told us up in Boston that he was confronted with a problem of the recovery of grease from wool scouring wastes. We suggested he talk to Harry Faber who reported on that at the Federation meeting in Chicago. We also suggest that any one else interested in the matter of grease removal attend the N. Y. State Sewage Works Assn. meeting in New York in January.—A whole afternoon devoted to the subject.

* * *

Sex rears its ugly head.—At the 4-States meeting in Philadelphia, R. J. Stewart read a paper on the use of feminine operators in a water plant. He had originally intended to title the article "Sex in the Filter Plant" but Mrs. Stewart had another idea. The paper as it appears in JAWWA in November is entitled, "Women Filter Plant Operators."

* * *

It was at the Atlantic City meeting of the N. J. Sect. AWWA in Nov. where Peter Pallo read a paper on the origin of drinking water standards quoting a man named Venner who "in 1622 presented to dwellers in cold countries, a formal accusation against drinking water by stating that 'it doth greatly deject their appetites, destroy the natural heat and overthrow the strength of the stomach and consequently confounding the concoction is the cause of crudities, fluctuations and windiness in the body.' "

* * *

Next time you see "Bill" Brush, that amiable editor of WWE and treasurer of AWWA, look for a new Tau Beta Pi key on his watch chain. A recent acquisition.

* * *

Bernard Rowntree says that at his sewage plant in Carmel, Cal., the gas production is 2 cf/cap/day whereas the books say 0.8 cf is normal, and he wants to know if the books are wrong. A fellow at Newark, N. J., asked us that same question once. The answer is simple, the explanation is not. The books are both right and wrong.

Gas production per capita varies because that particular unit is not basic. The explanation lies in the statement that the composition, weight, and volume of the gas produced in sludge digestion are chemically and mathematically dependent on the amount and composition of the organic matter which is converted into gas. The composition of the organic matter depends on the food habits of the population tributary and the industrial wastes present. The amount of organic matter capable of digestion depends on the same factors.

The amount of organic matter converted into gas depends not only on the amount available for such conversion, but also on the per cent digestion, which in turn depends on

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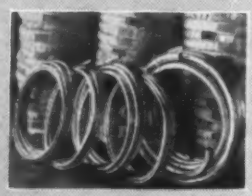

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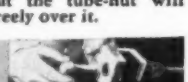
Cut ends of Type K Tube-Loy square and smooth edges with lead rasp. When a tubing cutter is employed, the finished surface requires no rasping. Ream out inside of the end of Type K Tube-Loy after cutting to make smoother edge for flaring.

2

Place the Superseal Tube Nut well back on the Type K Tube-Loy with the open thread end facing the end to be flared. The outside diameter of Type K Tube-Loy has been carefully calculated so that the tube-nut will pass freely over it.

3



Hold end of Type K Tube-Loy firmly with clamp. Make sure that the Type K Tube-Loy is gripped in the clamp so that the tubing edge is flush with recessed top surface of clamp.

4

Insert flaring top in the Type K Tube-Loy, with pilot end of the top entirely in the tube. Tap lightly with wooden or rawhide mallet, while holding clamp tight. Flare will be complete when end of Tube-Loy meets the shoulder on the flaring top.

5

To complete the connection, make on the Fitting to the valve, cock or meter, as the case may be, then bring the Tube Nut over the flare to make on to the Fitting.

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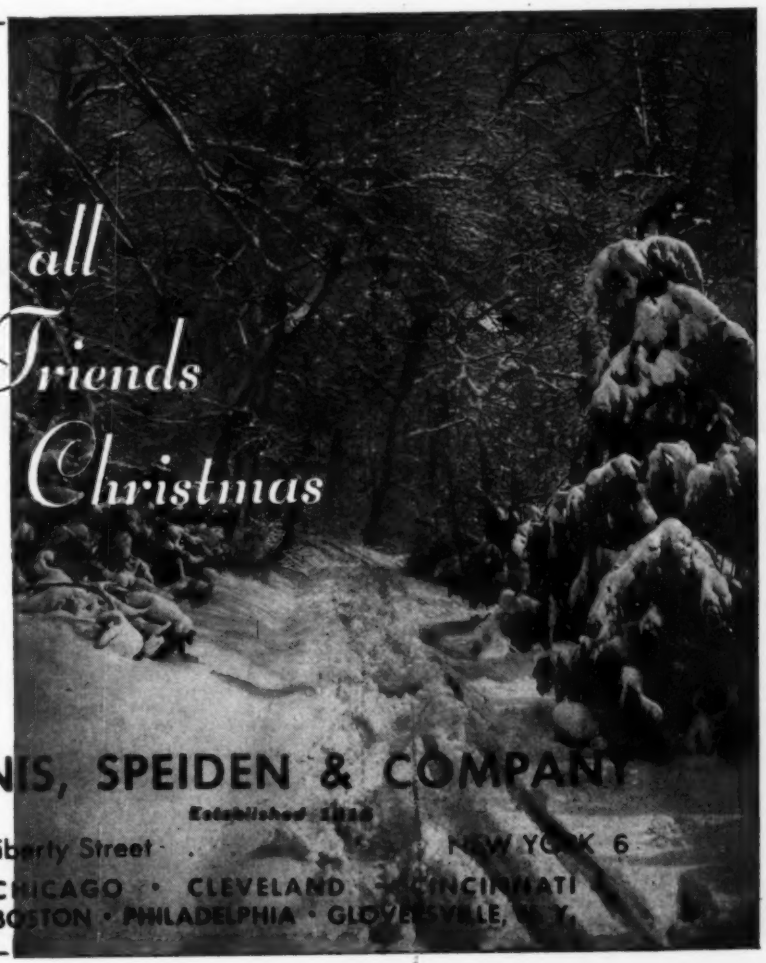
Wishing all Our Friends A Merry Christmas



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the temperature of the digestion and the time of digestion as well as that matter which is converted into bacterial protoplasm. Composition and therefore volume of gas will also be dependent on the alkalinity of the supernatant liquor, which in turn is dependent on the amount of ammonia produced from nitrogenous matter in the sludge.

The composition and therefore volume of the gas will likewise vary depending on the amount of carbon dioxide dissolved in the sludge and supernatant liquor removed, which, among other factors, will depend on the amount of raw sludge pumped. And one must not forget that most treatment works not only guesstimate the population tributary but also do not correct gas volumes for temperature and pressure as they should. Makes some difference, you know. All in all there are a number of reasons why two plants should not obtain the same per capita gas production. Yes, the answer is simple, but the explanation requires a thesis. In fact we wrote a thesis on the subject once. Perhaps it should be reprocessed to remove the sesquipedalian* verbosity, and published.

* * *

What's in a name? In this column and in our report on the N. Y. Section meeting we told about the man from Waterford, N. Y., where the water has such a terrific chlorine demand. We called him Jackson, but Yaxley sounds a little like Jackson, doesn't it?

* * *

It's difficult as this is written amid screaming headlines of "Remember Pearl Harbor," and "Axis

[**We think that readers of this column should demand that "Doc" be considerate enough to write another thesis to explain the meaning of s-e-s-q-u-i-p-e-d-a-l-i-a-n.—Ed.*]

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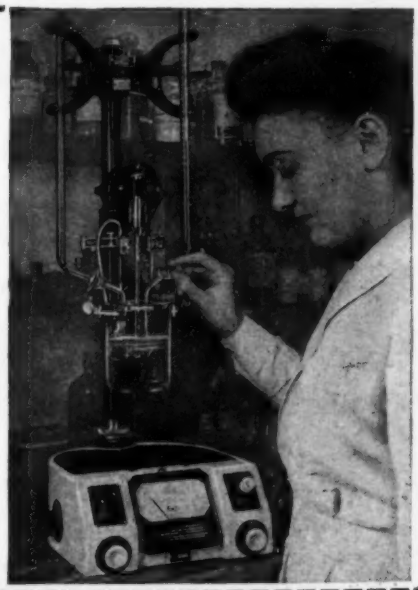

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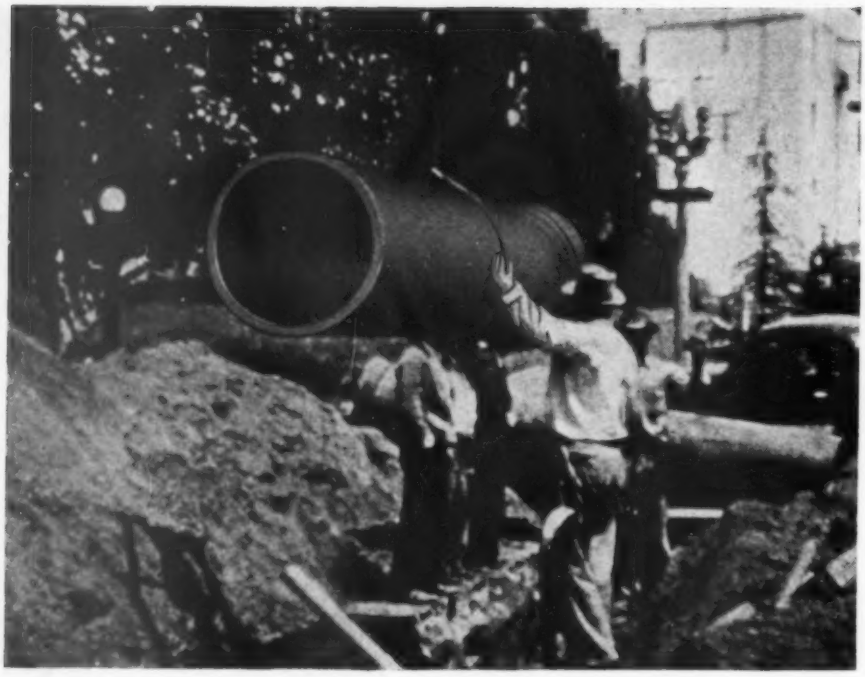

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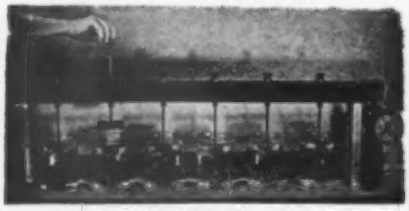

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- Sulphur base; quick sealing, speeding laying and backfilling.
- 10 lb. ingot form, easily handled, stored and shipped. Impervious to rain. Cannot change composition.
- Makes permanently tight joints. Goes 3 to 5 times as far as lead, helping conserve a strategic war metal.
- For money-saving information, write

The ATLAS MINERAL Products Company of Pa.

Mertztown Pennsylvania

Powers to Be Smashed" to realize that this is the season of "Peace on Earth to Men of Good Will." Perhaps had the Axis had some good will, we could send them Season's Greetings and Best Wishes for 1944, but war or no war we send these greetings and wishes to our readers.

MANUFACTURERS' and EQUIPMENT News

And Now Virginia Has Two Senator Birds

Lloyd C. of Richmond Wins State Senate Election

Lloyd C. Bird, until the recent elections had no better claim to distinction than that of being president

Senator Byrd of Virginia—suh!

of Phipps & Bird, laboratory supply house of Richmond, Va., which he established some 20 years ago and made of the venture a success. In the November election "Father Bird," as he is called by Richmond

SAVE MONEY USE ACTIVATED ALUM and BLACKALUM

STUART-BRUMLEY CORP.

516 North Charles St.

Baltimore Maryland

friends, stepped out into the limelight by successfully running for a State Senatorship representing several counties contiguous to Richmond.

At the recent annual meeting of the Virginia Section of A. W. W. A. in Roanoke, Va., "Father Bird" was receiving congratulations from his friends in the water and sewage field. Proud to know you, Senator!

"Rollie" Leveque Joins Omega

Roland J. Leveque, one time Marine, musician, filter plant superintendent, and more recently with Phipps and Bird of Richmond, Va., has joined the sales organization of

R. J. Leveque

the Omega Machine Co., of Kansas City, Mo., as Sales Manager.

Mr. Leveque, a native of Hartford, Conn., went to Virginia as a member of the U. S. Marine Corps in World War I. He was later not only a popular dance band leader in Fredericksburg, but also superintendent of the Fredericksburg filter plant for 14 years.

Nearly 3 years ago, "Rollie" graduated from filter plant operation, and took a managerial position with Phipps and Bird of Richmond, Va., suppliers of laboratory equipment, chemicals, and feeders.

To his new position as Sales Manager for Omega, Mr. Leveque brings the courage and determination of

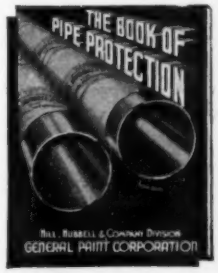
GASKET AND FORM
The Perfected Method for Making SEWER PIPE JOINTS OF CEMENT

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON Adams, Mass.

The preposterous elaboration in the Tower of Babel led only to confusion. We must all avoid visionary projects. The HILL-HUBBELL post war program is sanely conceived, and will be carried out *practically*.

Your Steel Pipe Protection needs will be met by improved methods, streamlined to handle all reasonable demands.



Write today for detailed information contained in "THE BOOK OF PIPE PROTECTION."

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. • Division • Cleveland, Ohio
• EXPORT OFFICE: SAN FRANCISCO, CALIFORNIA, U. S. A. •

ZECO GREENSAND ZEOLITE

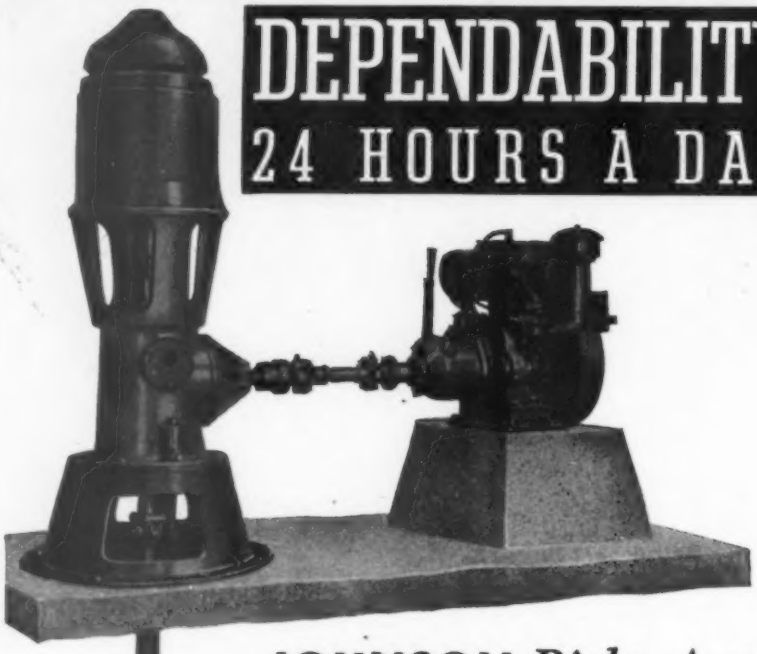
ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.
Sales Office 140 Cedar St. New York, N. Y. | Factory Medford, N. J.
Pioneer Producer of GREENSAND ZEOLITE MINERAL

BAILEY METERS AND CONTROLLERS
FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY
1072 IVANHOE ROAD • CLEVELAND, O.
Bailey Meter Co. Ltd., Montreal, Canada



DEPENDABILITY
24 HOURS A DAY

JOHNSON *Right-Angle* PUMP DRIVE

★ SEWAGE ★ WATER WORKS ★
FIRE FIGHTING ★ FLOOD CONTROL

The Johnson Right-Angle Gear Drive is used as a "connecting unit" between the pump and the power unit. Illustration shows a combination application. These drives are manufactured in a variety of types and sizes, each designed to meet the specifications of a wide range of applications—Sewage Disposal; Water Supply; Fire Fighting; Flood Control; etc.

★ EFFICIENT ★ DEPENDABLE
★ ECONOMICAL ★ COMPACT
★ FULLY ENCLOSED ★ LONG LIFE

The Johnson Right-Angle Gear Drive is sold through Pump and Engine Manufacturers—their local representative will explain the many advantages of this drive which is used by scores of municipalities. Write for Catalog No. 12.

JOHNSON GEAR & MANUFACTURING CO., LTD.
MAIN OFFICE AND WORKS: BERKELEY, CALIFORNIA

INCINERATION ENGINEERS

NICHOLS ENGINEERING & RESEARCH CORPORATION

60 WALL TOWER NEW YORK, N. Y.

Consultants • Designers • Constructors

the Marine Corps, the experiences of a filter plant operator, the esteem of his fellow waterworks men, indicated by his election chairmanship of the Virginia Section of A.W.W.A. in 1942, and a practical mind for developing equipment and ideas for use in the waterworks field. We think that Omega has picked a "winner" in this capable, likeable and spontaneous "Rollie" Leveque. Our congratulations to both.

Yeomans Bros. Appoint N. Y. Representative

Appointment of the Turbine Equipment Co., New York City, as exclusive representative for all Yeomans products in the New York metropolitan area effective December 1 has been announced by Yeomans Brothers Co. of Chicago, manufacturers of centrifugal pumps, rotary compressors, trickling filter distributors, clarifiers and other sewage treatment equipment.

An organization of 35 years standing, the Turbine Equipment Co. has sold and serviced pumping equipment from its founding in 1908. President of the concern is Russell Klemm, one of the founders. Harold Sinclair and Donald F. Miller are

P.F.T. Rotary Distributors at many war plants

Modern sewage treatment plants are the rule in today's military and armament establishments. In many of these, P.F.T. Rotary Distributors are installed to spread the effluent uniformly on the filter beds, assuring maximum utilization of the filtering area.

Write for Bulletin No. 213 containing full information, including engineering data which shows why the P.F.T. is by far the preferred rotary distributor.

P.F.T. PACIFIC FLUSH-TANK CO.
4241 Ravenswood Ave., Chicago
New York Charlotte, N. C.

vice-presidents, and Edward Hayes is secretary-treasurer. They head a sales and service organization of 25 persons, all of them associated with Turbine Equipment Co. for considerable periods.

Ralph Stotler of Badger Meter Dies

Ralph M. Stotler, longtime western sales manager of the Badger Meter Co., passed away in Kansas City on Nov. 25th, at the age of seventy. In his 48 years in the meter business, Mr. Stotler had been connected with but two firms, Pittsburgh and Badger, and was well known to many persons in the water works fraternity.

Chicago Bridge and Iron Now Lead Yard in LST Construction

The Chicago Bridge & Iron Co., well known fabricators of tanks, gasholders and gas scrubbers in the water sewage field, has seen its Seneca, Ill., shipyard become the "lead yard" in the U. S. Navy's new LST (Tank Landing Ship) construction program. LST's are now being

launched at the Seneca Yard at the rate of one a week. These ships, which are built for landing tanks on invasion shores, are 98 per cent complete when launched. The hulls of these ships are built largely from prefabricated sections made in the three Chicago Bridge plants at Birmingham, Ala., Greenville, Pa., and Chicago.

The accompanying picture shows one of the Tank Landing Ships which has just hit the water from the ways at Seneca. Chicago Bridge has reason to be proud of the record of their Seneca yard which flies multiple honor pennants awarded by the Army and Navy for production attainments in the war effort.

It shouldn't be long now until Chicago Bridge is again fabricating "Tanks for America" rather than tank ships for the seven seas.

VALVE OPERATION

THE "NEW WAY" MAINTENANCE CREW:
TWO MEN — ONE DEAN EQUIPPED TRUCK — NO EFFORT

TWO SIZES OF DEAN VALVE OPERATORS AVAILABLE: THE HEAVY DUTY MODEL FOR THE LARGE GATES AND THE JUNIOR MODEL FOR GATES UP TO 24 IN.

POSITIVE PROTECTION AGAINST DAMAGE TO VALVES BY THE SAFETY SHEAR PIN COUPLING

INSTALLED ON ANY TRUCK WITHIN A FEW HOURS—IN YOUR OWN GARAGE. ONLY FOUR HOLES TO DRILL IN FRAME.

EARLY SHIPMENT UNDER YOUR PRESENT PRIORITY.

The Old Way *The "DEAN" Way*

PAYNE DEAN & CO. Laconia, N. H.

Style 705 MERCURY FILTER CLOTH

Designed for Sewage and Disposal Plants

This all wool Mercury Filter Cloth is made from specially processed wool. Our 30 years of experience have proven that this wool withstands deterioration better and longer than other filter fabrics. Send us dimension of fabric you now use—we will be pleased to submit samples, price and full particulars.

Mercury

TECHNICAL CLOTH AND FELT CORPORATION ★ 1265 Broadway, New York, N. Y.

RENSSELAER

combined

AIR AND VACUUM RELIEF

and

AIR RELEASE VALVES

SIMPLE

in construction

DEPENDABLE

in operation

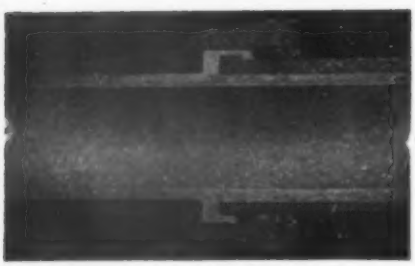
WRITE FOR BULLETIN Q

RENSSELAER VALVE CO.

TROY, N. Y.

View showing Tate Process in Pipe Joint. Note thoroughness of Lining.

Help Save Critical Materials · investigate **TATE Cement Lining Process**



With the increase in demand for Critical Materials in the Water Works field *now* is the time to investigate the Tate Cement Lining process—and see what it can do to restore the efficiency of your old water mains.

THE TATE PROCESS ACCOMPLISHES

1. Water mains cleaned and cement-lined without removing pipe.
2. Eliminates discoloration and further cleaning costs.
3. Reduces pumping costs.
4. Restores reduction in head and flow co-efficients. This means full fire protection and lowered insurance rates.
5. All Joints cement-lined . . . eliminates bacteria in joints.
6. Does the job with minimum interruption of service to consumer.

Write for Literature

TATE PIPE LININGS, Inc.

ANDOVER, MASS.

Dorr Studying Cathodic Protection, Looking to Improvements

The Westport Mill Laboratories of The Dorr Co., New York, are conducting a program of research and development on corrosion control of submerged metal structures by the cathodic system.

The cathodic system of corrosion control uses electrical current to nullify corrosion causes, such as local potential differences due to the non-uniformity of the metal surface, corroding solution, or both. It is expected that the work now being carried out at Westport will provide fundamental engineering knowledge which will make possible the efficient application of the system where corrosion is a problem in the sanitary field.

This program, involving both laboratory and field work, is being carried out in collaboration with the Electro Rust-Proofing Corp. of Dayton, Ohio, whose "Rustop" system of corrosion control is already used extensively to protect water storage tanks and other submerged steel structures.

Builders-Providence Appointments

Builders-Providence, Inc., of Providence, R. I., has announced that Mr. E. W. Gray, formerly located in their Philadelphia office, is now associated with Mr. G. H. Jewell in the Chicago office. Mr. Jewell has represented Builders in that locality for over 25 years. Mr. Winfield S. Codell returns to Builders' Philadelphia office as assistant to Mr. Alan A. Wood.

W. D. Taulman & Associates Establish Jacksonville Office

A letter from W. D. Taulman of Atlanta, Ga., says that Cy Timmons, who has been with his firm for the past year, has been located in Jacksonville, Fla., from which point he will cover Florida, the Georgia Coast, and west to Mobile. Mr. Timmons is a graduate of the University of South Carolina and has spent considerable time with the Farm Security Administration at Montgomery, Ala., handling the design and construction of water and sewage treatment plants.

Mr. Clem B. Edgar has also joined the firm recently and will handle the regular lines and specialize on lines of equipment that enter into the construction of power and steam plants.

QUALITY Gives The Answer

HYDRODARCO

The ACTIVATED CARBON

Specially Made for Water Treatment

Depend on Hydrodarco for quality that insures maximum palatability control per dollar . . . quality that gives real performance.

With the Threshold Odor Test, the Carbon Feed Chart and the Darcograph—scientific, simplified methods of evaluation—carbon performance can be checked right in your plant. Details furnished on your request.

Hydrodarco Reg. U. S. Pat. Off.

DARCO CORPORATION

60 East 42nd Steret, New York 17, N. Y.

Distributing Points: New York, Cincinnati, St. Louis, Buffalo, Chicago, Kansas City, San Francisco, Los Angeles, Marshall, Tex.

Mr. Edgar is a graduate of the University of Pittsburgh and has been located at Salt Lake City in the construction of the Columbia Steel Co. plant.

W. D. Taulman and Associates handle equipment for water, sewage, power, and industrial plants, and represent the Chapman Valve Co., Automatic Control Co., United Conveyor Corp., Simplex Valve & Meter Co., Atlas Mineral Products Co., American Well Works, and the Omega Machine Works.

Dr. Baum Heads Turco Sanitation Laboratory

To keep pace with new problems in public sanitation, a new research

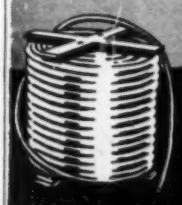
laboratory has been established in the Turco Los Angeles laboratory, according to S. G. Thornbury, presi-

HYDRO-TITE

HYDRO-TITE — The self-caulking joint compound that makes cast iron water pipe joints — strong — tight — flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

FIBREX — The sanitary paper packing that is used like braided jute. Free from bacteria — treated with a water repellent — put up in 60 pound reels. 70 pounds of Fibrex takes the place of 100 pounds of braided jute.

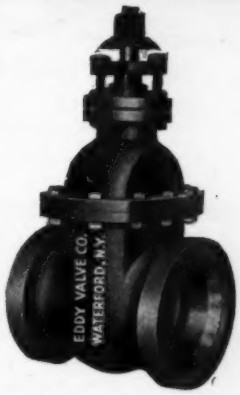
HYDRAULIC DEVELOPMENT CORPORATION
50 Church St.
New York, N. Y.



DRY BRAIDED *Fibrex*

EDDY

FIRE HYDRANTS AND VALVES—
WATER WORKS EQUIPMENT



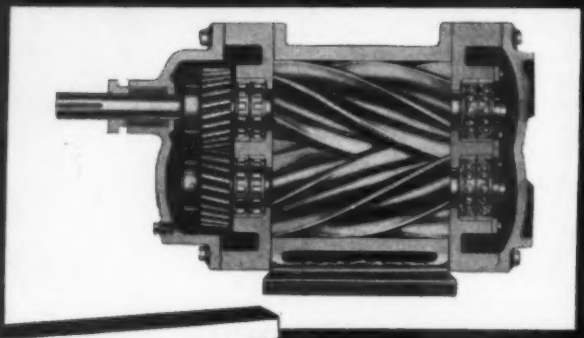
EDDY VALVES
For
Water Works
and
Sewage Disposal
Plants

EDDY FIRE HYDRANTS
For Fire
Protection
Service

Write for Complete Catalog

Eddy
VALVE COMPANY
WATERFORD, N.Y.

QUIMBY PUMPS



MAINTAIN INITIAL EFFICIENCY
throughout their serviceable lifetime.

QUIMBY PUMP COMPANY
INCORPORATED

dent of Turco Products, Inc. Dr. Nathaniel Baum of Chicago has been appointed head of the new department.

Doctor Baum, who has been a consulting chemist in organic synthesis and resins for the last six years, received his doctor's degree in chemistry at Columbia University in 1930.

Turco manufacturers more than 225 specialized industrial chemical compounds, many of which are used in sanitation practices.

F-M Personnel Changes

Changes in personnel at Fairbanks, Morse & Co. have recently been announced as follows: Mr. O. O. Lewis, formerly Branch Manager, Atlanta, Ga., has been promoted to the position of Assistant General Sales Manager of the company, Chicago.

Mr. G. N. Van Epps, formerly Manager of the Diesel Department, Chicago Branch, has been promoted to Branch Manager at Atlanta, Ga.

Mr. V. O. Harkness, former Manager of the company's branch at Dallas, Texas, has been appointed Manager of the Diesel Engine Sales Division, Chicago.

Mr. H. J. Renken, former Mana-

84" pipe—Spring Lake, N. J.

FLANGED PIPE
FLEXIBLE JOINT PIPE
BELL & SPIGOT PIPE
SPECIAL CASTINGS
SHORT BODY BELL & SPIGOT SPECIALS

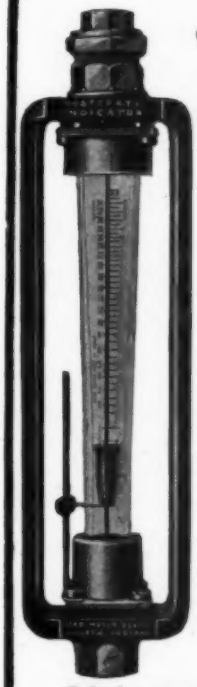
Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.
11 Broadway, New York

Warren Pipe Company of Mass., Inc.
75 Federal St., Boston



Testerate INDICATOR

Knowing the rate of flow in meter testing is almost as important as knowing that your tanks or scales are accurate. The Ford Testerate Indicator will tell you instantly and accurately the rate of flow in gallons per minute. Hundreds of these instruments are in service.

Ask for more information.

FORD METER BOX CO.
WABASH, IND.

WRITE FOR INFORMATION

VOGT BROTHERS TRAFFIC MODEL FIRE HYDRANT

A.W.W.A.

VOGT BROTHERS MFG. CO. Incorporated LOUISVILLE, KY.

MAIN AT 14th

VOGT

VOGT MFG. CO., Incorporated

P. O. BOX 1122 LOUISVILLE, KY.

AERO-MIX AERATOR—MIXER

AERATOR—MIXER

A Size and Type to Fit Your Problem in Water or Sewage Treatment.

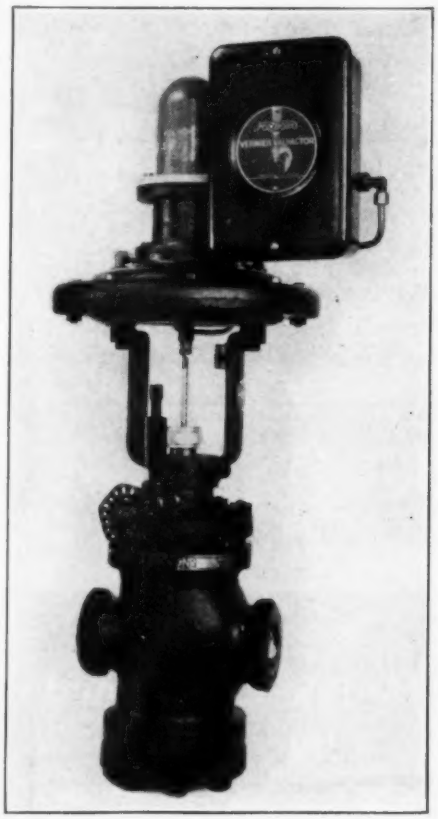
WRITE FOR INFORMATION

ger of the Oil Field Division at Dallas, has now been made Branch Manager at Dallas, Texas.

Mr. J. S. Peterson, formerly Scale Department Manager of the Cincinnati Branch, has been promoted to the office of Branch Manager.

New Features in Foxboro Valvactor

New capabilities, as well as new convenience and sturdiness, are featured in a new Foxboro Vernier



Valvactor used to insure precise and dependable valve response, especially where operating conditions may make the response uncertain, slow, or unsatisfactory. It is actuated by air pressure changes as slight as the

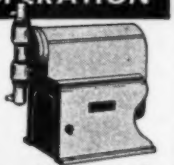
INQUIRIES INVITED on all Problems of WATER TREATMENT

Whether your problem of water rectification is large or small, we have a form of equipment to serve your needs. We manufacture and install equipment for Gravity Filtration and Softening Plants; Pressure Filters and Zeolite Softeners; Swimming Pool Recirculating Appliances; and Water Treatment Units of all types.

ROBERTS FILTER MFG. CO. 607 COLUMBIA AVE. DARBY, PA.

..for ACCURACY and TROUBLE-FREE OPERATION

INSIST ON THE WILSON PULSAFEEDER



Engineered and Manufactured by

WILSON CHEMICAL FEEDERS, INC.

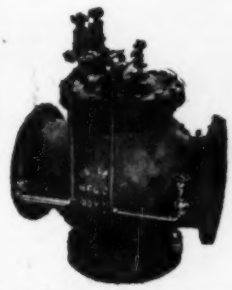
203 CLINTON STREET BUFFALO 4, N. Y.

1879

ROSS AUTOMATIC VALVES

ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES • FLOAT VALVES • REDUCING AND REGULATING VALVES

ALTITUDE VALVES for Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.



COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.

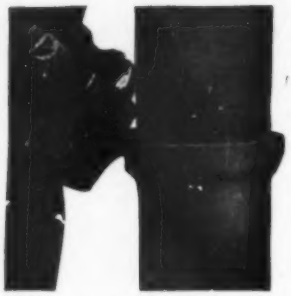
REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO. INCORPORATED

P. O. BOX 595, TROY, N. Y.

Economical-Effective Durable

SERVICISED
SEWER PIPE JOINTING COMPOUNDS



HOT POURED COMPOUND

Servicised Sewer Pipe Jointing Materials have served in the sewerage field through many years.

Our Hot Poured Compound is specially prepared for vitrified clay pipe used in sanitary sewerages.

Servicised Hot Poured Compound is quick setting and produces tough, flexible, long lasting joint connections. This material is shipped in Fiber Drum Containers that open very easily.

TUFFLEX . . . is a cold premixed troweling plastic material that is also widely used in jointing of vitrified clay pipe.

TUFFLEX is especially outstanding for use in wet trenches because the material will set under water, thereby assuring continuous pipe jointing.

The adhesive and cohesive qualities of this excellent compound are resultful in a highly waterproof and root repelling product.

Save time and labor cost by speeding up sewer pipe jointing with TUFFLEX. This material arrives on the job for immediate use.

Millions of pounds of Servicised Sewer Pipe Jointing Materials have been used throughout the country on Federal and Municipal Projects.

Pioneers in the Manufacture of Approved Construction Materials for Over 23 Years
SAMPLES AND DESCRIPTIVE LITERATURE WILL BE SENT UPON REQUEST

SERVICISED PRODUCTS CORP.
6051 West 65th Street, Chicago, Ill.

equivalent of ½ inch of water, and can compel valve stem movements as small as 1/1000 of an inch.

Continuing the same operating principles which have made the Vernier Valvactor so successful in eight years of widespread use, the new construction involves a completely different arrangement of the actuating elements. New ease and range of adjustment, especially for duplexing and sequencing, and new snap action for relay service or step sequencing of valves or damper motors, are provided by new, convenient zero and range adjustments. New ease of reversal is provided without change of parts or piping.

Although the Vernier Valvactor retains the same general external appearance, new ruggedness has been provided for it by a heavier metal case. Complete specifications of the new type unit will be furnished on request to The Foxboro Company, Foxboro, Mass.

Wade Mfg. and Woodruff & Edwards Join Forces

To be known as the Wade Mfg. Co., Division of Woodruff and Edwards, Inc., a new organization has been formed from the two companies. Products offered in the new

The
AERO-FILTER

- High capacity
  Raindrop application
  High degree of purification
- Low initial cost
  Low operating cost
- Disc and rotary distributors

Send for Bulletin 112—just issued
Complete information on design

Sewage purification. Also water softening, filtering and conditioning.

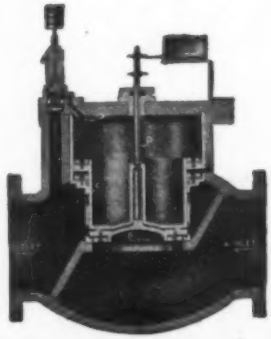
LAKESIDE ENGINEERING CORPORATION
222 W. ADAMS STREET
CHICAGO, ILLINOIS

Electric
Double Cushioned
Check Valve

This valve is for use in connection with remote tank storage service with valve located adjacent to motor centrifugal pump, also where a high-low pressure or float-operated switch located at tank is wired to the valve in order to accomplish complete automatic sequence of operation for starting and stopping the pump with respect to storage water levels.

Sizes 3" to 36", angle and globe patterns.

Write for specifications.



GOLDEN-ANDERSON
VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

HEAVY-DUTY INCINERATION
MORSE BOULGER
DESTRUCTORS

FOR THE

INCINERATION OF MUNICIPAL WASTES

GARBAGE, RUBBISH,
SEWAGE SCREENINGS
AND SLUDGE

FOR COMPLETE INFORMATION
CALL OR WRITE

MORSE BOULGER DESTRUCTOR CO.

HOME OFFICE:
216-W East 45th St., New York, N. Y.

Wade line include floor, shower, and roof drains, grease interceptors, traps and cleanouts, as well as the well known Wade "Wacor" Water Hammers Arrestor. Catalogs and literature may be obtained by writing to the Wade Manufacturing Co., Div. of Woodruff & Edwards, Inc., Elgin, Ill.

LITERATURE AND CATALOGS

Pipe and Tube Bending Handbook by the Copper & Brass Research Association has been announced. A new and complete treatise showing methods and devices for bending pipes and tubes of copper and its alloys, this book has been prepared at consumer's requests for authoritative information on this subject. It contains 80 pages of text with 113 figures and illustrations including 35 full pages of unit weights of tubes of different alloys with varying diameters, wall thicknesses and shape, as well as pertinent information on the chemical and physical properties of such pipe material.

The text covers subjects such as hot and cold bending, minimum radii, temper, the use of mandrels of various types and many other essential factors. Bending with the use of filler materials such as sand, rosin, salt and low melting temperature alloys are described and illustrated. Step by step procedures for both smooth and wrinkle bending of large diameter pipe show methods and equipment in considerable detail.

The Handbook is available to those who need information of this kind if they will write to Copper & Brass Research Association, 420 Lexington Avenue, New York 17, N. Y.

"A Digest of 65 Different Maintenance Jobs" in steam generating, electric power, or light plants, where Oakite cleaning materials and methods are being successfully used to expedite work, conserve man hours, help make existing equipment last longer, and perform more efficiently, is given in a book from the Engineering and Service Dept. of Oakite Products, Inc. With an index to enable the reader to obtain information quickly, the 16 pages of the bulletin contain the answers to many cleaning questions concerned with boilers, preheaters, cooling systems, air compressors, condensate receivers, coil surfaces, paint, varnish, insulators, gas meters, water meters, and many other items. This

STEWART SEWER CLEANING EQUIPMENT
MACHINES LEASED OR SOLD

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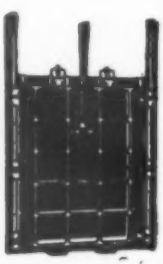

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One of the first house organ publications to adopt the slogan Blueprint Now is the *Cast Iron Pipe News* published by the Cast Iron Pipe Research Association. In the Oct. issue, not only is the release of the Committee on Water and Sewage Works Development reproduced, but breaks between paragraphs are set off with the motto "Blueprint Now." Included in this issue is a story of cast iron pipe installed for industrial and domestic use along the Alaskan Highway. There is also a story on cities reserving present water works profits for their post war water works needs.

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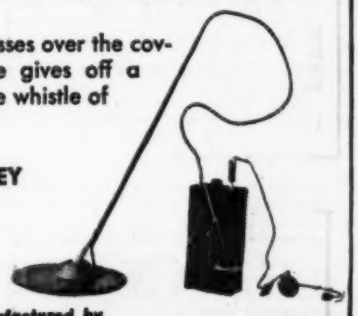

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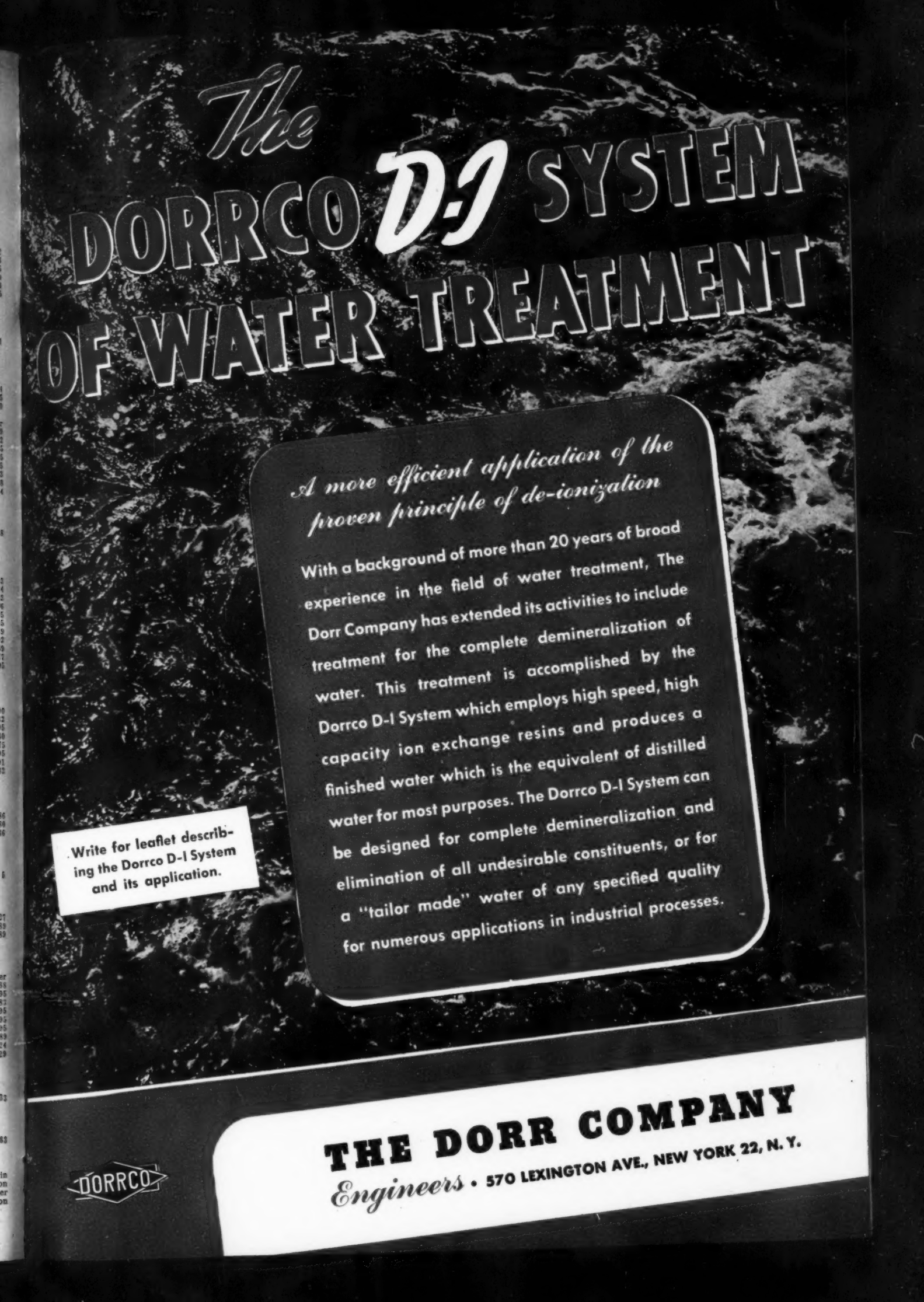
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